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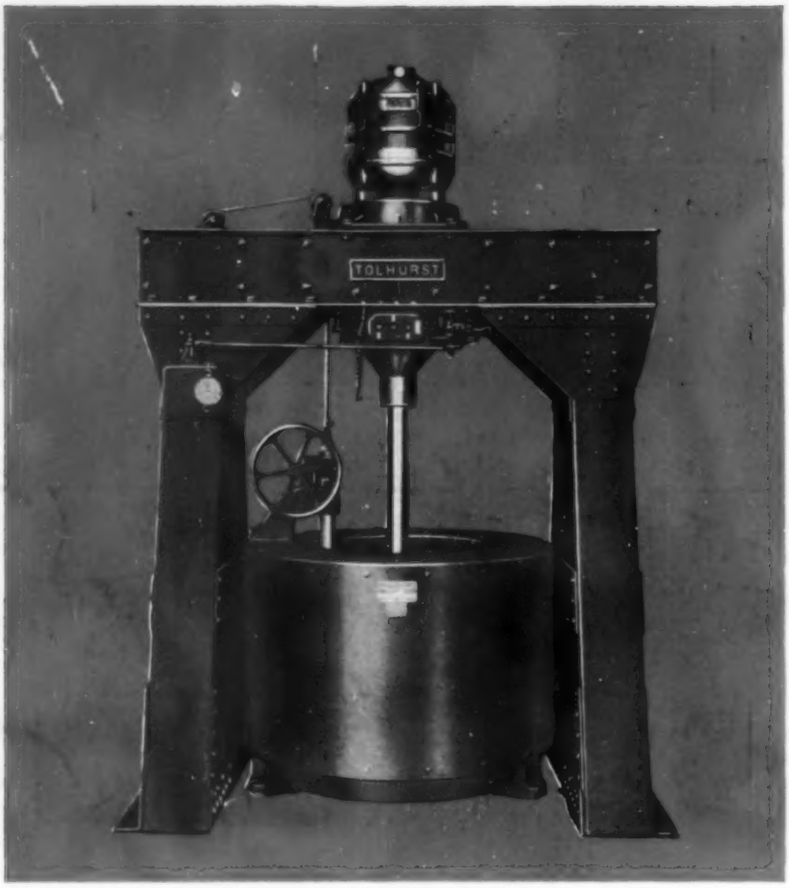

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CHEMICAL & METALLURGICAL ENGINEERING

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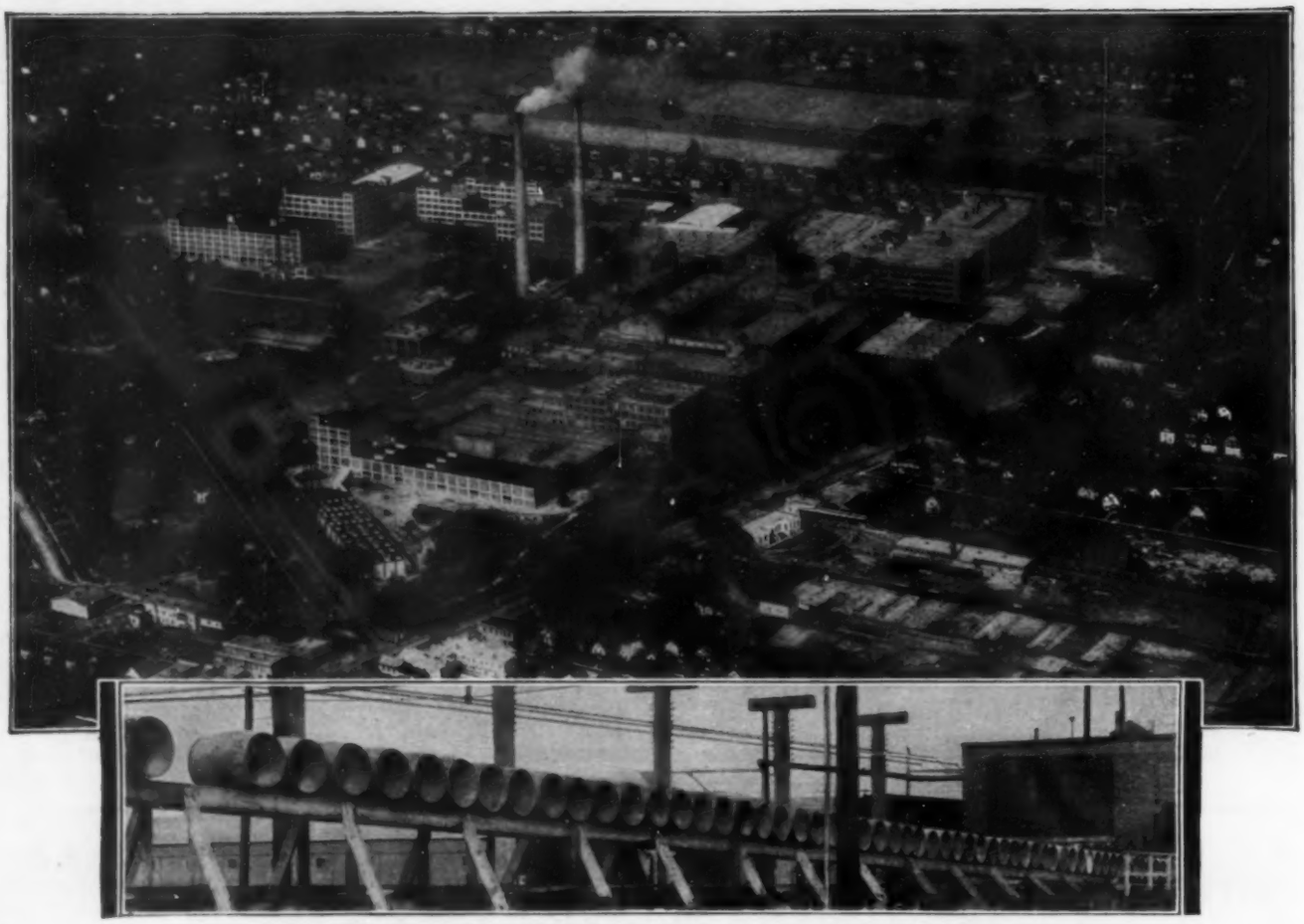

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S. D. KIRKPATRICK, *Editor*

The Real Index of Tomorrow's Profits

BECAUSE many chemical industries are relatively new or are constantly changing in scope and development, they possess but little background of financial history. Particularly in a period of adjustment in security values, such as the present, is there an urgent demand for some satisfactory measure of true worth. The wise investor is inclined to look beyond the present balance sheet in order to appraise, if he can, certain intangible values that represent the attitude of management toward research in the fundamentals of both production and distribution. Fortunately, there has lately been a remarkable strengthening of this foundation on which chemical industry is to build its future profits.

DIRECTORS of research in ten of the largest companies in the field of *Chemical & Metallurgical Engineering* have lately reported on programs of investigation and development that in the aggregate will total more than twenty-five millions of dollars. New laboratories or the extension of research facilities are already under way in a number of plants. The guiding motive in all of this activity is aptly summarized by a statement of the president of one of the largest rubber companies: "We regard research as one of the most important parts of our business. During times of depression this department is even more vital, if possible, than in so-called boom times." But depression in chemical industry is not in prospect. Executives of four of the companies included in the previous group have announced plans for plant expansion in 1930 which will amount to almost a hundred million dollars. Others, although unable for one reason or another to give exact values, have outlined developments that will undoubtedly bring the total for the industry to a quarter of a billion dollars.

THIS is the program reported to President Hoover on December 5 by the representatives of the Manufacturing Chemists Association. At the same meeting, E. M. Allen declared that 1929 will be the largest and most prosperous year ever experienced in American chemical industry. More important, it will be exceeded next year if business can be relieved of the state of uncertainty under which it now must labor. Mr. Allen's reference was made particularly to certain discouraging activities of the United States Senate.

THE PRESENT SITUATION calls for action—but of the sort that is based on fact rather than conjecture. "Research," says Dr. Julius Klein, "is capable of contributing mightily to a renewed vitalizing and accelerating of all business currents. Indeed, the very job that now confronts us is to find just where the slack is—if any—and to set up prompt reserves to readjust our industrial and commercial balance." No industry is better equipped in men and methods. It remains for chemical executives to apply these research talents, as never before, in proving that a business so established must continue to prosper.

In Language of the Engineer

WITH the directness and clarity of an engineering report, with the maximum of economic reasoning and the minimum of practical politics, President Hoover's first message to the Congress is a gratifying document. To the chemical engineer it is particularly pleasing to find again the same clear-cut conception of the Muscle Shoals problem which Mr. Hoover has consistently advocated throughout the past five years of political turmoil. To lease the plants for private operation as "chemical and electrical enterprises," to dedicate the proceeds for "experimentation on a commercial scale in agricultural chemistry" and, finally, to appoint a technically competent commission to negotiate and complete the contracts on behalf of the government is indeed sound procedure. Incidentally, it is exactly the recommendation that the two engineer members of the Muscle Shoals Inquiry of 1925 presented to President Coolidge in their well-conceived minority report.

Patent Legislation Affecting Industry

SEVERAL bills regarding patents which have important significance for industry will be pending in the next session of Congress. Some of this legislation has had serious consideration by limited groups, but the real significance of the proposed acts has probably not been widely appreciated in many of the industries which would be materially affected if the proposed legislation were enacted.

The most vicious of these bills is an amendment of the Tariff Act as a proposed Section 526, approved by the Senate September 24, 1929. This would prevent import of any goods into the United States if bearing a registered trademark owned by a citizen or corporation of the United States, or goods marked to indicate the patent or patents under which they are being manufactured and sold. These restrictions are avowedly intended to restrict the importation of such goods on the theory that this will tend to compel manufacture within the United States and thus afford additional work for the wage earners of the country.

The Merchants' Association of New York has had a careful inquiry made as to the significance and the desirability of this amendment to the tariff statutes. Their report unequivocally condemns the legislation. The Patent Section of the American Bar Association also has given serious attention to the question, and the vast majority of its membership seems, at least in a general way, to join in the condemnation of this indirect form of "working clause" to compel American manufacture of patented and trademarked goods.

Direct opposition to the more fundamental change in patent law requiring American manufacture which has been proposed in several recent bills is expressed by the Patent Section of the American Bar Association. Its committee even questions the constitutionality of a compulsory license law when the commodity or device covered by the patent is not made in the United States. It also draws a very important distinction between "suppression" of patents and merely "non-use" of patents. The following generalizations are amplified in a splendid report which was favorably acted upon at the Memphis meeting of the Association in October:

> Such non-use of patented inventions as there may be is justified by sound economic reasons and it would be against public interest to penalize it.
>
> It could not reasonably be expected, particularly in the light of decisions under foreign patent laws, that fair terms for compulsory licenses would be fixed by a government bureau.
>
> The inevitable result of a compulsory license law would be to discourage inventions and retard the country's industrial development.

Fraudulent practice by unscrupulous and unregistered persons representing themselves as patent attorneys would be severely restricted if the original Cramton bill (H.R. 699, 71st Congress) were enacted. This bill as drawn contained certain unfortunate phrasings that met with opposition both among lawyers and among engineers, but, as indicated in these columns last month, the objections have been very fully met in the new form of the bill which the Commissioner of Patents and Representative Cramton now are presenting for the consideration of the Congress.

Illegal use of patents through agreement, understanding, license or cross license will automatically cancel the exclusiveness of a patent for its owner if the Dill bill is enacted. This act in its original form was extreme and so drastic as to be absolutely unreasonable, probably even unconstitutional in effect. In that form it provided that any concern which in any of its affairs was indulging directly or indirectly in violation of the laws regarding restraint of trade and monopoly would lose all defense against those who chose to infringe its patents. Such a sweeping and general penalty was not approved by the Senate Committee on Patents. The modified bill merely makes as an adequate defense the demonstration by an infringer that the owner of the patent which he infringes is a party to a combination doing such illegal thing in restraint of trade by the use or control of the specific patent in question.

These four items of legislation regarding patents are by no means all of those of importance to industry that will receive attention in the next session of Congress. They are enough, however, conclusively to demonstrate the importance of having executives, technical men, and patent counsel of the industry give close attention to the proceedings of the patent committees of both houses of Congress.

As Editors Viewed Industrial New England

BASIC INDUSTRIAL IDEAS of interchange in manufactures, standardization, mass production and other phases of scientific management had their origin in New England factories. Now, after many years of leadership, New England is taking stock of its economic assets and liabilities and through the New England Council it has created a remarkable agency for unified and constructive action. To broaden our own perspective as well as to assist others in making an impartial survey of New England's progress, a group of twenty McGraw-Hill editors, headed by H. C. Parmelee, recently completed a thousand-mile tour embracing visits to sixty-eight factories in fifty-one cities scattered throughout the six states. The observations of these editors, summarized and reported back to the New Eng-

land Council on November 22 by Earl Whitehorne, afford an interesting cross-section of industrial New England. To some extent they likewise offer a basis for studying and improving industrial conditions in other sections of the country.

New England has many favorable factors: The diversification of its industrial structure as a whole is undoubtedly impressive and a surprising proportion of its cities are themselves trending steadily in that direction. Through generations of development it has reared a race of skilled industrial labor that forms a great reservoir of vital wealth. The use of specialized equipment has reached a forward position and many plants have developed automatic machinery and efficient methods of handling materials through the flow of parts in progressive assembly. In certain industries there is conspicuous progress in the application of research to the utilization of byproducts and the development of markets. There are some examples of the most advanced personnel work in the form of well organized trade schools, shop councils, sanitary and hospital facilities and recreational provisions. Railway transportation receives almost universal commendation throughout the area and the reorganization of freight service that has been effected in recent years provides a resource for industrial development. The development of both hydro and steam generation and the interconnection of systems affords as progressive a service as is available in any section of the country and at favorable rates.

But it is surprising to find that in the presence of such conspicuous examples of enterprise and progress many industries have failed to modernize and are suffering the costly economic blight of partial obsolescence. Of course, in any section it is likewise true that the most modern plants are in the minority. There are always a few leaders who have seized upon the most advanced ideas and excel in their efficiencies, while the others trail until the pressure of a more intelligent competition compels them to reform their outworn practices. New England industry is carrying a staggering burden of old buildings. They are not adapted to the efficient arrangement of modern machinery nor to present ideas of materials handling. Too many are crowded into the center of congested districts where the value of land is high. It would pay better to erect new buildings on the fringe of town than to suffer longer the costs entailed by using ill-adapted structures.

Many of the older industries are clinging to obsolete equipment because it has been written off and represents no book investment. They are denying themselves the practical economies of new equipment that is worth infinitely more. In many cases there are forests of overhead belting, heavy friction load, labor wasting machinery and old power plants that are an inescapable drag on profits. The lighting of New England factories is distressingly bad, despite a few examples of the most advanced industrial illumination. This condition takes an inevitable toll in accidents, slow speed and spoilage of material. There are many cases of bad housekeeping, poorly arranged machinery, cluttered aisles, neglect of ventilation, painting, cleaning, and modern sanitation facilities. There is a noticeable lack of the practical safeguards applied to machines, belts and tools that must be the backbone of all accident prevention work. Much hand work still lingers that can be eliminated by mechanization.

It is true, of course, that many of these criticisms could likewise be applied to other industrial sections of the country. But with the background of highly diversified industry, with well-organized facilities for group action and with a determined will to go ahead, New England has all of the elements that make prosperity. It but remains to develop and apply more broadly the principles and spirit of industrial modernization.

The Russian Bear Responds to Red

MOTION on a grand scale has a deceptive immobility about it that is likely to conceal its true significance, and direction even, until its destination is already attained or some sympathetic disturbance has been created along its course. The Union of Socialist Soviet Republics—otherwise Soviet Russia—is surely such a kinetic mass, for, just as everyone is agreed on the fact of its movement, so everyone is neatly at variance in his certainty of its ultimate destiny; and meanwhile the outside world begins involuntarily to sway in accord or discord. It need hardly be added that malcomprehension has usually chosen the human form of disapproval, but with the growing concession—well nigh compulsory now—that the spectacle will bear close watching.

A sketch of this spectacle, seen from a chemical engineering angle, is offered on later pages of this issue, where enough is revealed at least to emphasize the altogether significant lengths to which Russia's newly-embraced faith is stirring her. And the other strange aspect of her systematic straining toward self-sufficiency is her frank enrollment, on a strict business basis, of all that the surrounding world may contribute. Not only does some leading foreign group enter into the direction and execution of each new enterprise but an active call is sent out for individual engineers, especially Americans, to help "better" themselves by "bettering" Russia. *Chem. & Met.* sees further evidence of this phenomenon in her subscription lists, where Russia's count is as heavy as Germany's. In fine, the Soviets have confronted Russia with a task that is stupendous by any criterion; and they hope to make a fair purchase of the foreign experience to see it properly undertaken.

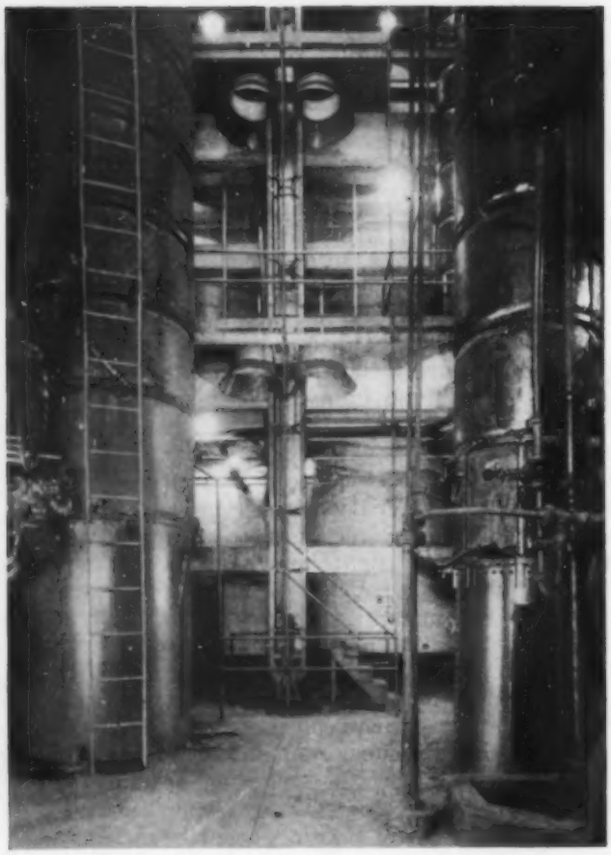
Outsiders, impatient of paternalistic manipulation anyway, are likely to see in the whole Russian program primarily an object of moralistic debate. Losses attendent on the rise of the Soviet state, no less than imaginary scruples, have occasioned such quandaries as the refusal of national recognition and such natural grievances as the one lodged by the Russo-Asiatic Consolidated, Ltd., in the *Engineering and Mining Journal* recently. Well, in the end the cold dictates of a business prospect will dispose of any warm attitudinizing; and who are we anyway, in our smug democracy, to care how gloomily the Russian wants to keep house?

What the whole question seems to represent, in this light, is that any past losses incurred by foreigners can be met—if ever they are—only by a thriving Russia and that Russia offers to become a baneful factor after purchasing outside help, at full rates. The fear that Russia's Marxian doctrines will prove contagious is absurd if the American and European social system is sound; in fact, the contact of outsiders with them should be an automatic safeguard in this respect. Meanwhile American engineering firms and individuals have an unusual opportunity for possible benefit to themselves and the world at large, a disregard of which cannot be justified on the ground of moral inconsistency alone.

Ethyl Alcohol Industry

Improves Its

Economic and technologic considerations dictate lower fuel consumption and better recovery of byproducts



Two Rectifying Stills for Ethyl Alcohol; Man Lift in Background

EVERY chemical industry strives for the adaptation of new engineering principles. A study of one of the oldest industries, the manufacture of ethyl alcohol, its present status, the various systems used for its recovery and their efficiency, therefore is of interest to those who are directly or indirectly applying distillation or evaporation in their plant. That the engineering principles applied in the ethyl alcohol industry are benefiting such others as the oil industry cannot be disputed. The development of stills to a high degree of efficiency in the former has opened possibilities in the recovery and separation of fractions in the refining of petroleum. These new fields have resulted in less costly and less complicated processes and equipment.

Since the enactment of the prohibition laws the raw material for the manufacture of ethyl alcohol is mainly the so-called "blackstrap" molasses from which the recovery of the sugar is either uneconomical, as is the case with cane molasses, or requires considerable investment as applied in the case of beet sugar molasses.

To produce ethyl alcohol, molasses must be diluted to the point at which the yeast is able to decompose the sugar into ethyl alcohol and carbonic acid gas. This dilution of molasses depends to a great extent, also, upon the ultimate utilization or disposal of the de-alcoholized fermented molasses. If it is desired to manufacture ethyl alcohol only, then, according to the usual method as applied in this country, molasses is diluted in a ratio approximately of 1:5. However, if it is desirable to process the de-alcoholized fermented molasses, called "slop" or "vinasse," for the recovery of potash and nitrogen, or other valuable byproducts, then the ratio of dilution is 1:3 to 1:4. The higher the ratio, the larger the quantity of water which must be subsequently evaporated. Consequently the fuel as well as investment in equipment are proportionally higher.

Molasses contains the sugar in the form of sucrose and glucose. Sucrose does not ferment but after inversion caused by addition of sulphuric acid it is fermentable. Approximately 5 gal. of 60 deg. Bé. sulphuric acid is used per 1,000 gal. of molasses. Ammonium sulphate and sometimes phosphates, such as trisodium phosphate, are also added. These substances are considered the so-called "yeast foods." In order to ferment the inverted sugar it is preferable to add a pure culture yeast which converts the sugar into ethyl alcohol and carbon dioxide as shown in the above equation. After the fermentation is completed the "beer" contains 6 to 10 per cent of ethyl alcohol which is recovered by straight distillation or by other methods to be described later.

WHILE the general conception is that the production of alcohol is large, its rapid growth for industrial uses is not realized. Table I shows the production of denatured alcohol and that disposed of at denaturing plants as published by the U. S. Treasury Department for the various fiscal years ended June 30.

Increased production of ethyl alcohol obviously increases the use of molasses and larger quantities of slop

Distillation Processes

By Gustave T. Reich

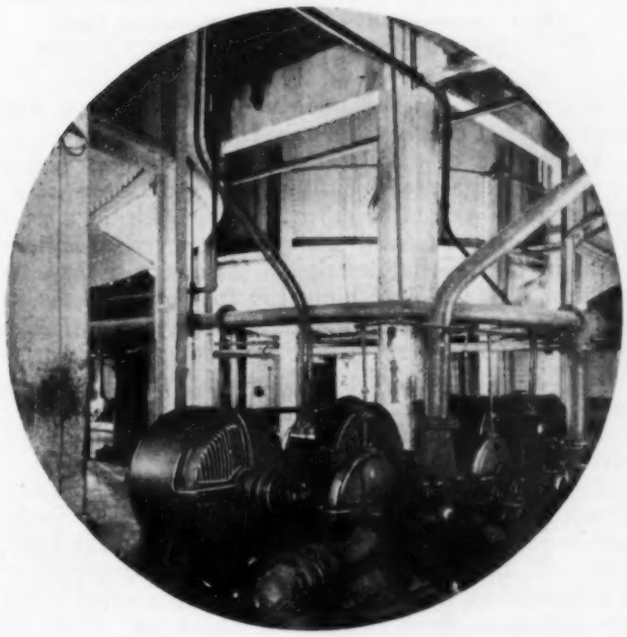
Pennsylvania Sugar Company, Philadelphia, Pa.

Table I—Production of Denatured Alcohol

Fiscal Year	No. of Plants	Completely Denatured Gal.	Specially Denatured Produced Gal.	Total Gal.
1920	52	13,528,402.99	15,307,947.18	28,836,350.17
1921	67	12,392,595.02	9,996,229.90	22,388,824.92
1922	77	16,193,523.60	17,152,224.31	33,345,747.91
1923	76	27,128,229.54	30,436,913.14	57,565,142.68
1924	83	34,602,003.72	33,085,292.04	67,687,295.76
1925	91	46,983,969.88	34,824,303.28	81,808,273.16
1926	97	65,881,442.43	39,494,443.80	105,375,886.23
1927	94	56,093,748.16	39,354,933.48	95,448,681.64
1928	82	46,966,601.28	45,451,424.28	92,418,025.56

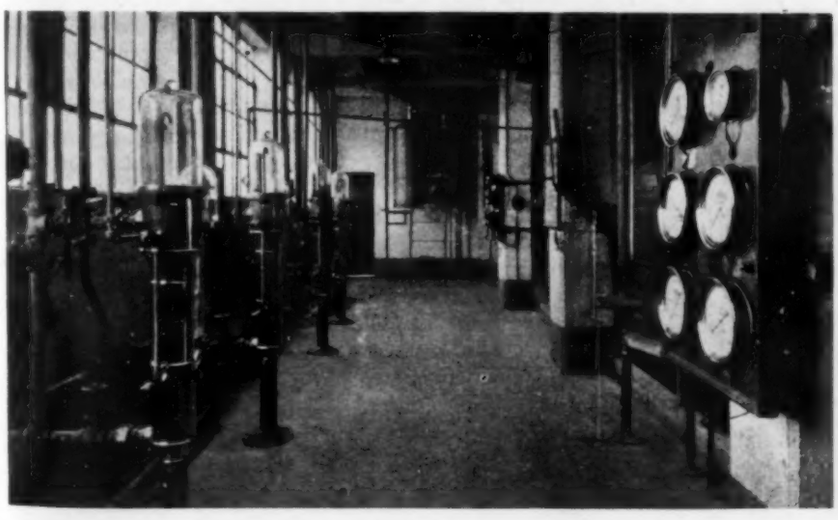
must be run to waste. This is obviously an immense waste and in addition is attended with more and more objections on the part of health authorities. The increase in price of molasses raises the price of ethyl alcohol, which is approaching almost the limiting value, if the market is to be maintained. Production of the synthetic methanol has changed the situation very materially, since a much higher price of 95 per cent ethyl alcohol will, in many cases, compel manufacturers to use water-free methanol. The presence of water and denaturants in industrial alcohol and the absence of government restriction upon the use and production of methanol will be favored by industry.

Ethyl alcohol distilleries are therefore adopting more and more up-to-date equipment to reduce their manufacturing costs and are striving to eliminate waste by recovering valuable products from their slops. Distilleries operating in this country may be classified as follows: (1) Manufacturing ethyl alcohol exclusively. (2) Manufacturing ethyl alcohol and carbon dioxide. (3) Manufacturing ethyl alcohol and solvents. (4) Manufacturing ethyl alcohol, carbon dioxide, fertilizer and solvents. By far the largest number of distilleries belong to group 1.



Section of Fermenting Room
In the background, 100,000-gal. ingot iron fermenters, and in foreground, beer and wort d.c. pumps with fume-proof motors.

Still Operating Gallery



The methods of the recovery of ethyl alcohol from the fermented molasses of grain may be divided into two main classes: (a) Distillation under pressure. (b) Distillation under vacuum.

According to the method applied for the removal of vapors the above divisions can be subdivided as follows: (1) Combination of continuous beer still and batch rectifier. (2) Use of separate continuous stills only. (3) One continuous unit of beer still and rectifier. (4) Use of vacuum and

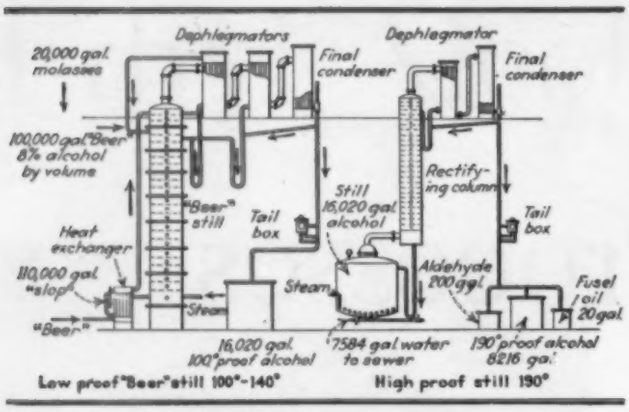


Fig. 1—Continuous Beer and Batch Rectifying Stills
The steam consumption is 43-46 lb. per gallon of 190 deg. proof ethyl alcohol.

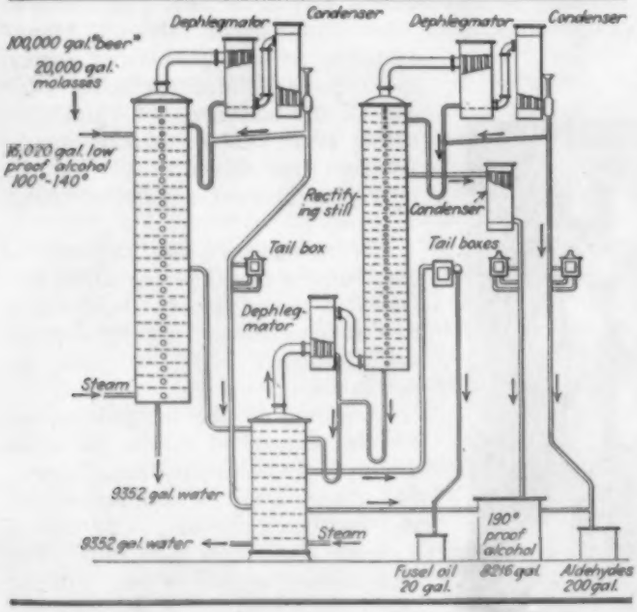
pressure stills. (5) Combination of evaporator with beer still and continuous rectifier.

While some of these methods have been described in various books and periodicals, they are not used extensively nor advocated by others familiar with the alcohol industry. It is deemed advisable, however, to include them in the present description inasmuch as they are guides which will lead ultimately to the more efficient recovery of ethyl alcohol, since the outlay on fuel is so preponderous an item of cost amounting at present to 35 to 55 per cent of the total manufacturing expenses, less the molasses.

Various methods for the recovery of ethyl alcohol are given diagrammatically in Figs. 1 to 6.

Fig. 1 shows a continuous beer still operated in conjunction with a batch rectifier. While the pressure in the continuous beer still is almost the same as in the batch beer still, the former is operated on the principle of counter-current flow. Beer, after being preheated by the alcohol vapors, flows over several plates with which the beer still is provided and during its downward flow is scrubbed by live steam, which removes all the alcohol, aldehydes and fusel oil. De-alcoholized slop or vinasse flows from the base of the beer still to the sewer. The

Fig. 2—A Continuous Rectifying Still
The steam consumption is 39-42 lb. per gallon of 190 deg. proof ethyl alcohol.



beer still is provided with a heat exchanger, dephlegmator and condenser. The heat exchanger actually acts also as a dephlegmator. The difference between the first and second dephlegmator is that the cooling medium in one is water and in the other, beer. The beer still is either provided with caps or perforated plates, depending to a large extent upon whether the fermented molasses contains scale-forming impurities. From 2 to 5 lb. pressure usually is carried in the still and the ethyl alcohol recovered has a strength of 100 to 140 proof. This distillate usually contains not only ethyl alcohol but the byproducts which were formed during the fermentation.

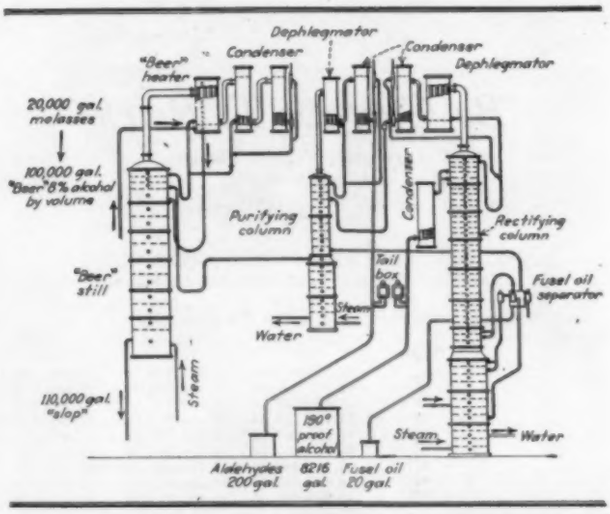


Fig. 3—Barbet or Guillaume Ethyl Alcohol Still
The steam consumption is 35-37 lb. per gallon of 190 deg. proof ethyl alcohol.

They are the low boiling aldehydes and the high boiling fusel oil, which class includes all the higher alcohols, such as propyl, butyl and amyl, having boiling points higher than ethyl alcohol.

Fig. 2 shows a continuous rectifier which receives the low-proof alcohol from a continuous beer still as shown in Fig. 1 but each operating as an independent unit. Fig. 3 shows a continuous beer still and rectifier. They represent the highest type of stills and are referred to as Barbet or Guillaume stills. While some distilleries have made changes in them to suit special requirements, in the main this type of stills is used. Fuel economy in these stills compared to batch and semi-batch stills is indeed great. In practice one gallon of 190 deg. proof alcohol is produced with a steam consumption of 35 to 38 lb. while the semi-continuous stills require 42 to 45 lb. of steam. Economy is achieved by the application of various heat exchangers.

A continuous beer still is shown in Fig. 4. It is heated by an attached evaporator and operated under three to five pounds pressure, according to the Chute process (U. S. patent 963,275). The advantages of this evaporator still over that of the continuous beer stills is that the de-alcoholized beer is not diluted with the steam, the heat being added indirectly. Exhaust steam is preferably used in the steam chest and the vapors obtained from the slop are utilized for the de-alcoholization of the beer. The slop partly concentrated is evaporated afterward in a triple or quadruple effect evaporator. In case no "slopping back" is practiced; i.e., a part of the slop coming from the evaporator is used for the dilution of grain or molasses instead of water, thereby increasing the percentage of solids in the slop and requiring less evapora-

See Jan '30 Discussion

tion, the evaporator capacity will be five per cent smaller than under standard operation.

A combination of pressure and vacuum still as suggested by Gallingaert (*Chem. Met. Eng.*; Vol. 32, p. 362) is shown in Fig. 5. According to this method a series of stills is connected as a multiple-effect evaporator and the vapors utilized from one for the de-alcoholization in the next. Stills utilized for this purpose being under vacuum, must have twice as many plates as when operated under pressure. The advantages claimed for this method of distillation are a reduction of fixed charges on the investment in equipment per unit of product, and the fact that under pressure below 70 mm. of mercury there is no constant boiling point mixture, and 100 per cent alcohol can be obtained by distillation.

Fig. 6 shows combination of stills and evaporator according to the author's process (U. S. patent 1,599,185). In distilleries in which the slop is processed, the usual procedure is to separate the ethyl alcohol first and concentrate the slop afterwards. According to this process, the concentration of the slop and recovery of alcohol proceeds simultaneously. The evaporators are used for de-alcoholizing and concentrating purposes and the ethyl alcohol vapors are recovered as "low wine" of 40 to 60 proof, depending upon the alcohol content of the beer, construction of evaporator and number of effects used. The low wine is further purified and strengthened in a continuous rectifier. In this process there is substituted for the beer still a multiple effect evaporator.

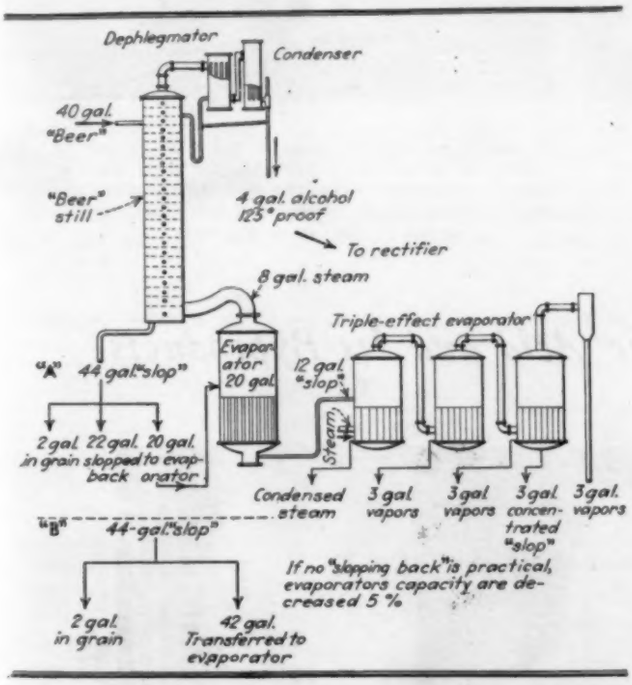


Fig. 4—Chute's Process for Alcohol Rectification

Assuming that a triple effect evaporator is used for de-alcoholizing purposes and that the ethyl alcohol content in the beer is 8 per cent, the evaporators are operated on the parallel current principle. For the heating of the steam chest, exhaust and live steam are used. It is very advisable for distilleries to utilize steam driven machinery as much as possible since the exhaust steam is available for distillation and evaporation purposes. Under actual plant conditions, the vapor pressure in the first effect has been operated under 5 lb. pressure; second effect, 12 in. vacuum, and third effect, 27 in. of vacuum. The ethyl

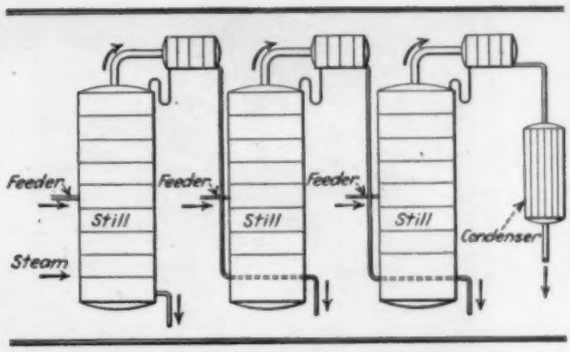


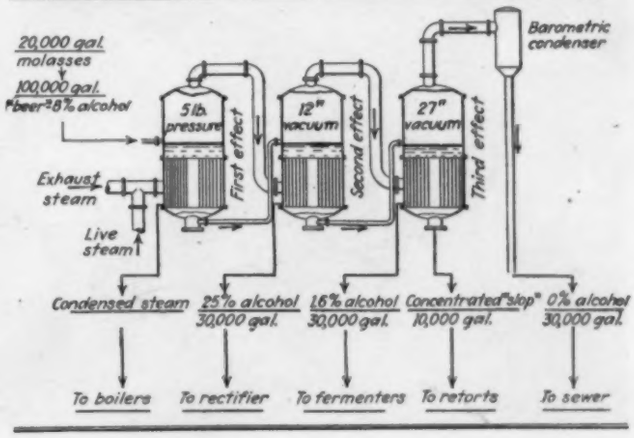
Fig. 5—Multiple-Effect Alcohol Still
According to this method, a series of stills is connected as a multiple-effect evaporator and the vapors are utilized from one for the de-alcoholization in the next.

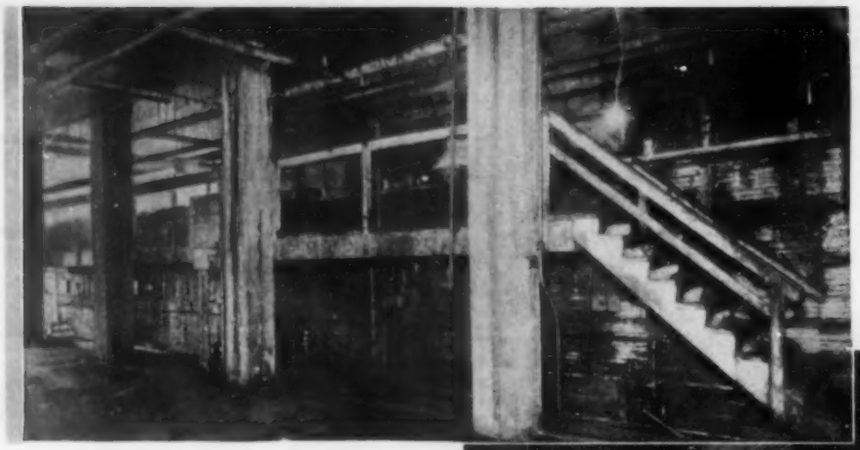
alcohol content of the vapors in the first effect was 25 to 28 per cent by volume, second effect, 1.6 per cent. The vapors in the third effect are free of ethyl alcohol and condensed in the barometric condenser. The condensate being low in ethyl alcohol, is used for the dilution of molasses while the ethyl alcohol rich in condensate is rectified in the usual manner. In this instance the fuel consumption for the recovery of alcohol is reduced approximately 50 per cent. The volumes indicated are approximate as they vary in different plants owing to local conditions. For the methods of calculation of data, the reader is referred to Weber & Robinson's "Evaporation," and Badger's "Heat Transfer and Evaporation."

Various factors enter into the distillation of ethyl alcohol such as whether hot or cold low-proof alcohol is to be supplied to the rectifier, size and number of chambers in the rectifying column, method of manipulation of the still and fermenters, cooling surface available. The fuel consumption per gallon of alcohol is therefore approximate. However, the last three processes described, show the desirability of improved methods in this industry since it is very apparent that the outlay on fuel is so large an item of cost. The reason for this high fuel consumption is the low percentage of ethyl alcohol in the beer and the exceptionally low potash and nitrogen content in the slop.

In conclusion, mention should be made of the manufacture of absolute alcohol by the use of azeotropic mixtures described by Lloyd C. Cooley [*Chem. & Met. Eng.*, Vol. 34, p. 725 (1927)] and practiced on a large scale by the U. S. Industrial Alcohol Company.

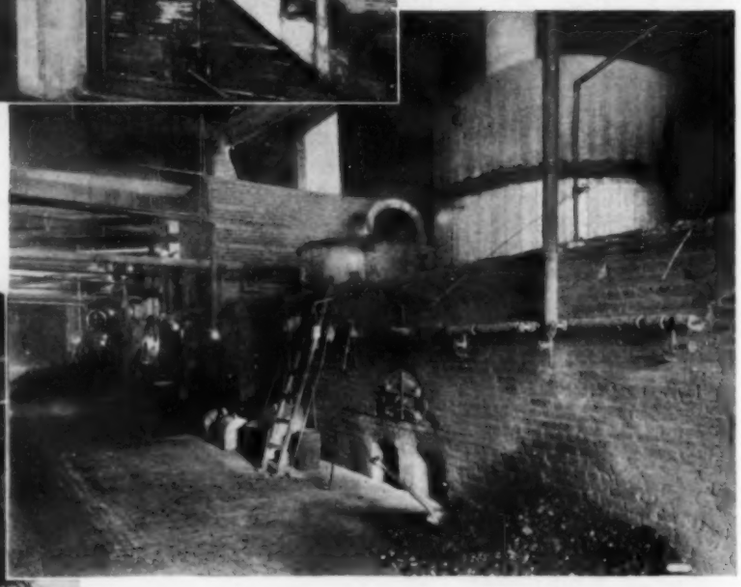
Fig. 6—A Combination of Stills and Evaporator According to the Reich Process
In this process the concentration of the slop and recovery of alcohol proceeds simultaneously.



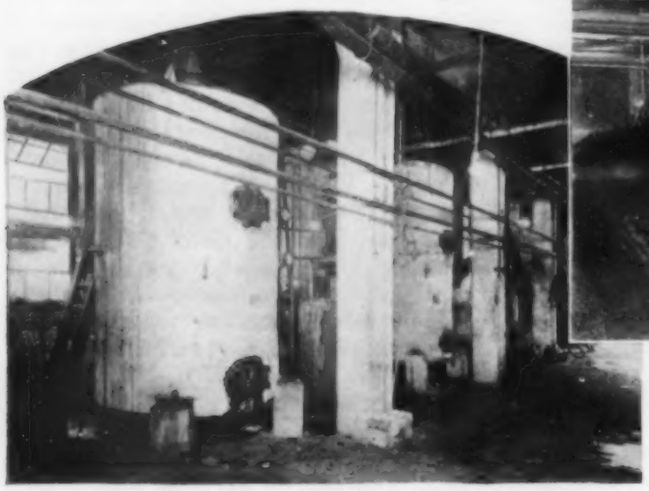


In the copper-lined tanks at the left the washed fats are split to fatty acids and glycerine by means of Twitchell's reagent

Large cast-iron, coal-fired vacuum stills below purify the mixed stearic and oleic acids by distillation. Note the separately fired superheater at the left of the center

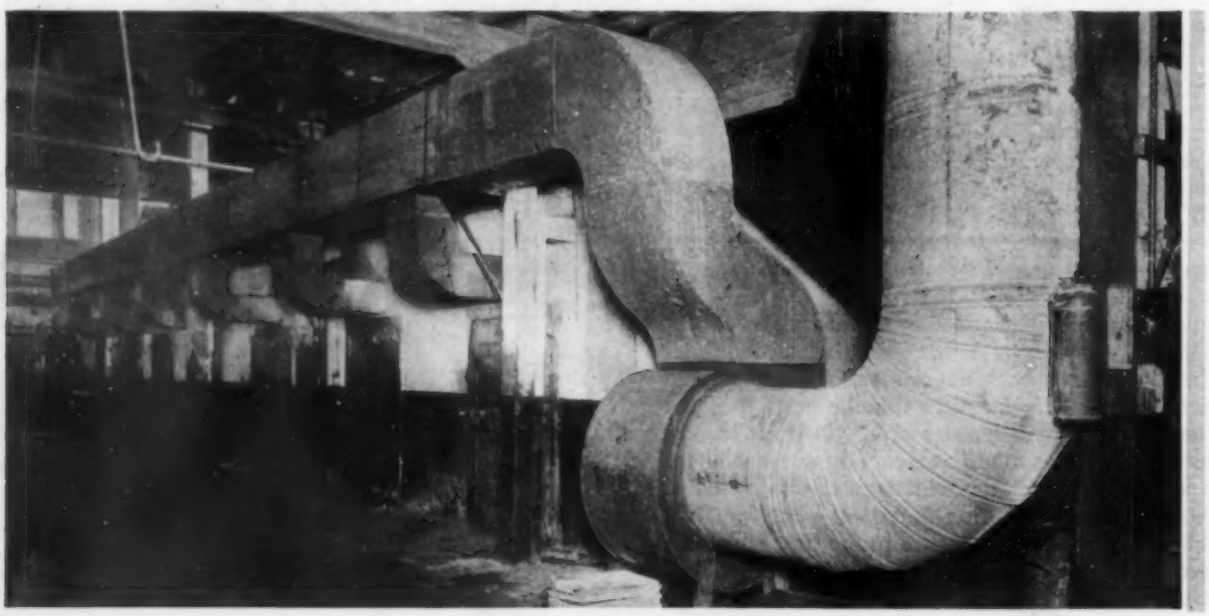


Vacuum evaporators below are used in a two-stage concentration of the byproduct glycerine



Below is an exterior view of the chill rooms where the mixed acids are solidified after distillation and prior to the cold-pressing operation. Refrigerated air is blown into the rooms by means of the fan at the right

Key Steps in Making Stearic Acid and Its Byproducts



Chemical Engineering in a Modern STEARIC ACID Plant

General View of the Plant of Emery Industries, Inc., at Ivorydale, Ohio

By Theodore R. Olive

Assistant Editor, Chem. & Met.

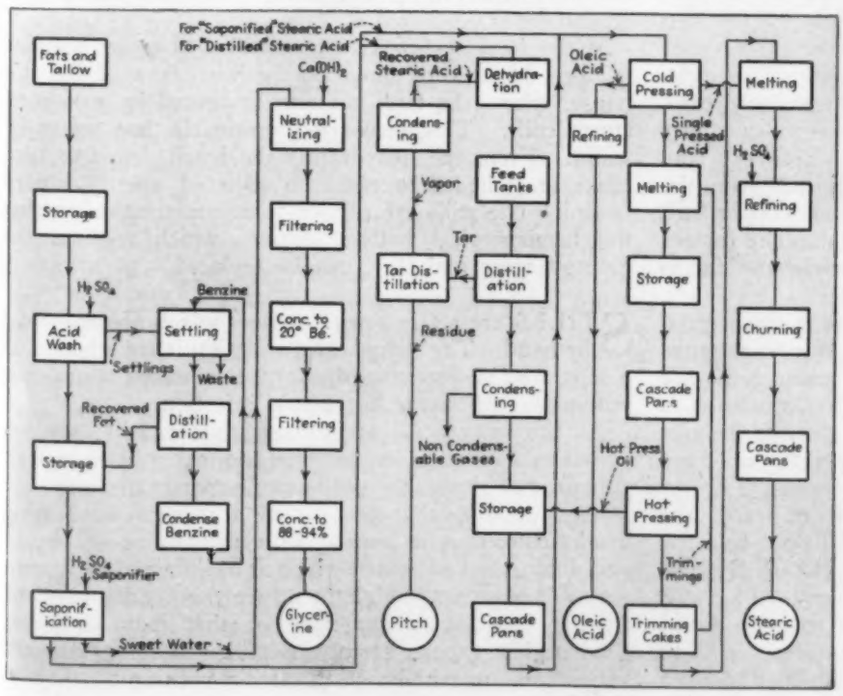
MANUFACTURE of stearic acid has received surprisingly little attention in the technical press in view of its considerable importance. During 1928, the industry in the United States produced a total of over 44,000,000 lb. of all grades of the acid, together with byproducts in the form of a slightly lesser quantity of red oil or oleic acid and about 10 per cent of the weight of the primary product in glycerine. The total value of this output is estimated at about ten million dollars and Bureau of the Census figures for 1927 give the number of plants as ten.

Stearic acid, as the figures would indicate, is a widely used raw material for a considerable range of products, including candles, cosmetics and toilet preparations, buffing compounds, for leather, pharmaceuticals, stearate driers and shoe and metal polishes. Over one-quarter of the production is used as a softener and for improving the dispersion of pigments and the vulcanization in rubber manufacturer. The primary byproduct, red oil, finds application in oiling wool and waterproofing fabrics, in leather manufacture, cosmetics, soap, candles, polishing and metal cleaning compounds and in paint driers.

Stearic acid production is one of our older chemical industries. In its essentials, it has undergone little change in the last 50 years, although refinements in process, to be described here, have been introduced in some plants. The raw materials of stearic acid manufacture are fats and tallows, byproducts of the packing industry. These consist largely of mixtures of the triglycerides of stearic, oleic and palmitic acids. It is first necessary to split off the glycerine, after which various refining operations are used to prepare the acid of commerce. Early means of splitting included saponification of the fat by boiling with strong sulphuric acid; a fermentation process making use of the lipolytic action of certain enzymes; and an autoclave treatment in which the fats were subjected to steam under pressures in excess of 100 lb. in the presence of lime or magnesia.

Today the most widely used process is that employing the reagents developed by the late Ernst Twitchell. These are fatty aromatic sulphonic acids which have the property of promoting hydrolysis of fats when present in relatively small proportions. It was in the plant of the Emery Candle Company, at Cincinnati, now Emery Industries, Inc., the locale of the present description, that Dr. Twitchell originally made these important discoveries.

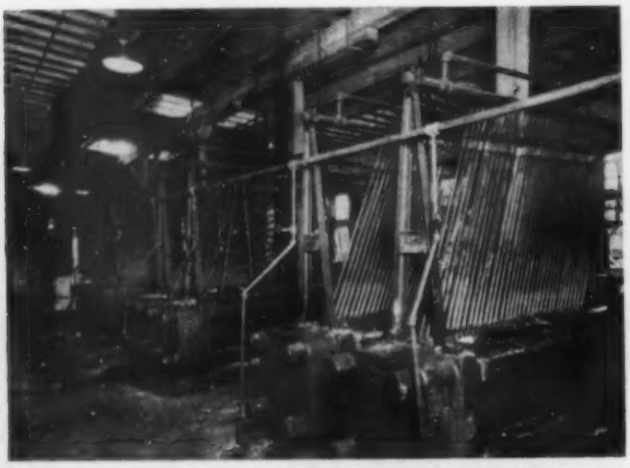
Principal Steps in the Manufacture of Stearic Acid and Its Byproducts Are Shown in the Flow Chart Below



A considerable proportion of the stearic acid output of the Emery company, which is the world's largest producer of this commodity, is consumed on the spot by the company's candle division. In addition to its manufacturing activities, the company carries out an extensive research program in its semi-works laboratory.

The raw materials, chiefly pressed fats and tallows from the Chicago district, come into the plant in drums and tank cars from which the contents is melted by direct steam and discharged by gravity to large underground receiving tanks. The various grades of fats—soft, medium and hard—are stored separately and later pumped to storage in steel tanks located on the ground level. Fats in storage at every stage of the process are kept fluid by means of steam coils.

After a blending operation in which various grades of fats are mixed in proportions to yield the desired



Hot Pressing Removes the Bulk of the Oleic Acid Remaining in the Stearic Acid After Cold Pressing

characteristics in the ultimate product, an acid wash is necessary. This accomplishes a certain degree of cleaning of the materials. Fats are charged into open lead-lined wood tanks with a small quantity of 60 deg. Bé. sulphuric acid and boiled with live steam. This step prevents the formation of emulsions at later stages of the process. After the boil, the batch settles overnight. The following day the settlings, containing some grease, dilute acid and dirt, are run to small wooden tubs pending accumulation of sufficient material for a recovery run. This consists in a benzine extraction of the fat from the settlings, in copper apparatus. A special copper still serves to separate the benzine from the fat. The former is recovered for the next extraction while the fat is added to the material from the acid wash.

After the washing operation, the grease is transferred by bronze reciprocating pumps to elevated storage tanks in the saponification building. On a lower level are copper-lined vats used in the next step which is a saponification or splitting of the fats. Vents for the vats are of copper, discharging to a coke-packed tower where the fumes are absorbed in cold water.

A charge of fat is run into a quantity of water, the source of which will appear later, equal to one-half the weight of the fat. Twitchell's reagent (D. P. Saponifier), to the amount of about 2 per cent, and about ¾ per cent, of 60 deg. Bé. sulphuric acid are added and the batch boiled with live steam until hydrolysis is 85 to 90 per cent complete. The batch now contains 85-90 per cent free fatty acid expressed as oleic and about 15 per cent glycerine. If the boiling were carried further, there would be reversal of the reaction.

The batch is allowed to settle and the dilute glycerine is run off to tanks on a lower level, where it is treated with calcium hydrate to neutralize the acid. The glycerine is next passed through an iron plate and frame filter press to remove the greater part of the $CaSO_4$. Vertical single-effect evaporators made of iron take the sweet water from the press and carry the concentration to about 20 deg. Bé., at which point the solubility of the dissolved $CaSO_4$ is at a minimum. The partially concentrated sweet water is then passed through a second filter press to remove the bulk of the remaining $CaSO_4$.

Final concentration is carried to 88-94 per cent in a single vertical evaporator. Vacuum is maintained in all evaporators by means of surface condensers, evacuated by water jets and wet vacuum pumps in series.

The concentrated glycerine, a good crude, is not refined further. It contains 88-94 per cent of glycerine and a small quantity of ash and organic residue.

Returning to the splitting operation on the fats, we find saponification 85-90 per cent completed. At this stage most of the glycerine has been removed. Fresh water and acid, equal in quantity to that used at the first stage of the hydrolysis, are added and the batch is boiled for about ten hours, or until the split has produced 95-97 per cent free fatty acid. After settling, the fatty acids are run off and the water is left in the vats, forming the water previously referred to as make-up for a new batch. Any additional glycerine split off in the second boil is thus saved, and without the necessity for concentrating a very dilute product.

The following step may or may not be distillation of the fatty acids, depending upon the ultimate product. The grade known as "saponified" stearic acid, used largely in the double-pressed form by the buffing trade and as a triple-pressed product in cosmetics and pharmaceuticals, is made from a higher grade of fats and Twitchell's reagent than the other qualities, and does not involve distillation. It should be noted, however, that all other stages in the operations on this product are identical with those to be described. Separate but similar equipment is employed.

If the fatty acids are to be distilled, they are pumped to open dehydrating tanks on the third floor of the still house, where the tank contents is heated by means of steam coils. This serves to remove the last traces of water. From the dehydrators the batch drops to feed tanks and thence to cast-iron stills of special Emery design. The stills are of two-piece construction so that the hemispherical bottom section, which receives the greatest wear and tear, can be replaced.

STILLS are set in brick furnaces which are coal-fired by hand. The steam for distillation is superheated in a separate coal-fired superheater. Perforated steam coils within the still serve for steam injection.

As the fatty acids are charged into a still they are raised to distillation temperature and, under the action of superheated steam, the pure acids vaporize and pass out through a copper goose-neck to a pair of condensing drums connected in series. The drums are of copper and submerged in water which is maintained at a temperature sufficiently high to insure the condensation of all the fatty acids but none of the steam or other condensable vapors from the still. At intervals the fatty acids are withdrawn through a vacuum trap.

Vacuum is maintained at the stills by means of water-jet barometric condensers to which the vapors not condensed in the drums are conducted. Cooling water from the condensers is pumped over a cooling tower and then returned. Two double-impeller exhausters of the two-lobe type, sealed with water and driven by means of short-center, multiple-V-belt drives, serve to remove non-condensable gases from the condenser battery. The water seal is an ingenious arrangement whereby water is fed into the suction of the exhausters and discharges to a tee. One branch of the tee leads to a water-sealed catch tank, while the other conducts the fumes, separated from the water, to the atmosphere.

The stills are fed continuously for a period of 48 to 60 hours, after which it is necessary to discharge the crude tarry residue left by the distillation. The fire is pulled, the vacuum broken, and the tar run to a sump tank from which it can be blown to the tar stills. Tar distillation is a topping operation, producing a black fatty acid that is returned to the dehydrating tanks and mixed with a fresh, undistilled batch. The residue in the stills is stearin pitch and is sold in three qualities without further treatment. It finds a ready market in the manufacture of insulating compounds, coating materials, roofing paper, rubber substitutes and similar products.

FATTY ACIDS from the stills are pumped from the receivers to storage in the press house. Operations in this department are designed to separate the oleic acid, fluid at room temperature, from the stearic acid, which is solid under these conditions. In the storage tanks, where the materials are kept liquid by steam coils, hot-press oil (or return stock) from a later stage of the process is added. The mixture, after settling, is run to a cork-insulated chill room where the acids are cast into slabs. The rooms are fitted with racks, reaching from floor to ceiling, in which aluminum or graniteware pans, formed into a lip at one end, are stacked. As the pans are stacked, each alternate pan is turned with the lip in the opposite direction from the one above and is staggered slightly, so that a cascade formation exists. Acids are then run into the topmost pan of each series and overflow from pan to pan as each is filled.

Once all the pans in a room have been filled, atmospheric air is blown through for a time, followed by refrigerated air. After a cooling period the solidified acids are ready for cold pressing. It is the pressing operations, both cold and hot, that serve to separate red oil from the solid stearic acid.

Solidified cakes are removed from the pan and each is wrapped separately in cloth and placed between the separators of a vertical hydraulic press. A pressure of 3,000 lb. per square inch forces a large part of the oleic acid out of the mass. The liquid is caught by gutters and conducted to underground storage from which it is pumped to the refining department. As soon as the oil ceases to flow, pressure is released and the stearic acid, left behind as a cake, is removed from the cloth and dumped into an underground receiver where it is melted by steam coils. This acid is "cold-press" cake.

The melted cold-press cake is now pumped to overhead storage, whence it is dropped to another group of cascaded pans, cooled entirely with atmospheric air forced across the acid by large fans. At this stage the solidified acid is of higher melting point, harder and lighter in color than the product of the first solidification. It is now ready for the hot pressing.

Hot presses are so constructed that wrapping of the cold-press cakes is not necessary. The presses are horizontal, consisting of a number of steam-heated platens supported movably upon a pair of side bars. Between the platens are heavy mat slings made of animal hair. One cake is dropped into each sling, the press is closed up partially and the steam turned on for a short time as the pressure is being applied. After this sweating operation, the pressure is run up to 3,000 lb. and the oil which is squeezed out is caught in troughs beneath the presses. The oil is mainly oleic acid, but the heat has caused that melting of a part of the stearic acid, as well. Hence, this "hot-press" oil, as it is called, is returned to the process in the storage tanks which precede the first refrigeration of the acids. Also, the edges of the cakes contain a considerable quantity of oleic acid. For this reason the edges are trimmed off after the press has been unloaded, the trimmings being returned to the cold-press cake sump. The remainder of the hot-press cake is melted and pumped to the finishing department.

Acid at this stage is known as double-pressed, distilled or saponified stearic acid, as the case may be. According to the specifications of the National Association of Stearic Acid Manufacturers, this grade of acid has a melting point of 128-129 deg. F. The single-pressed product should melt at 126-127 deg. F. and the triple-pressed, at 130-131 deg. F.

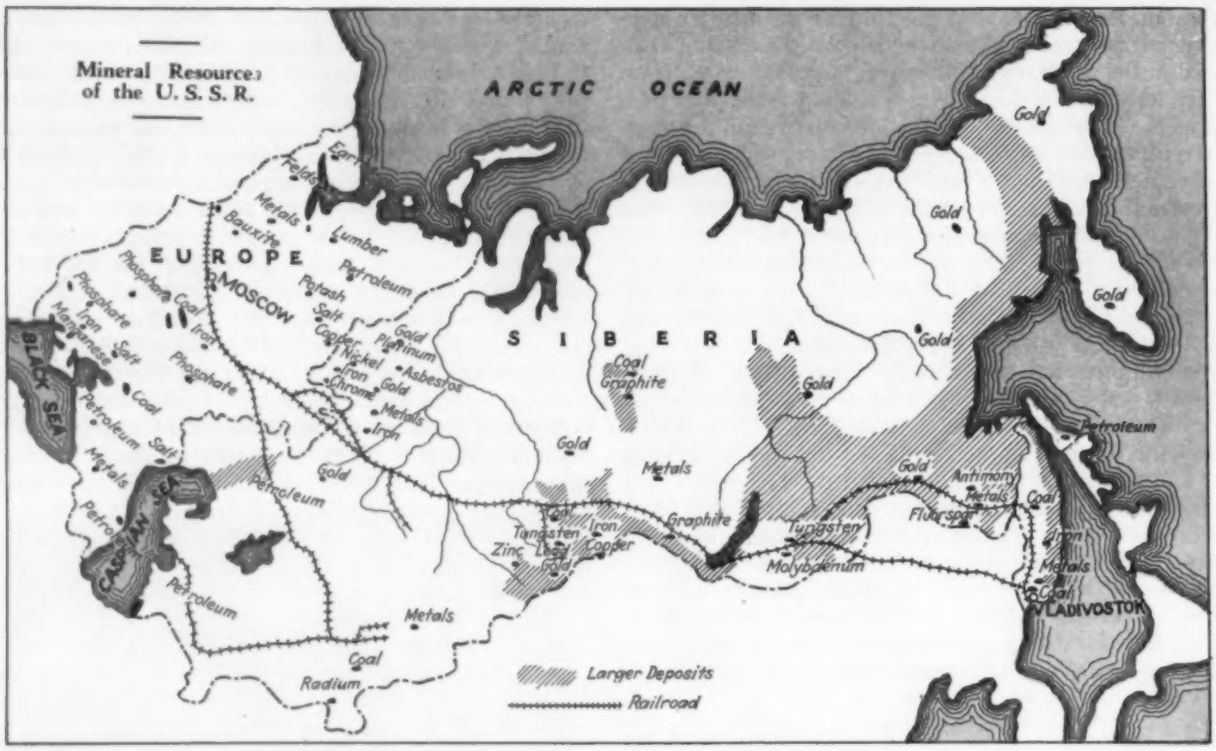
The finishing process is common to all grades of acid. The melted material is pumped to elevated lead-lined tanks where it is boiled with live steam and a little sulphuric acid to remove dirt and water.

Cakes of stearic acid constitute the common form in which the acid is prepared, although some of the product is prepared in powdered form. The melted

As a Final Operation Stearic Acid Is Crystallized in the Churns at Right, Then Cooled in Pans at Left

acid from the purification step drops to storage tanks on a lower floor and thence to churns, long wooden tanks containing a horizontal paddle agitator. In the churns small crystals begin to take shape, whereupon the liquid, now in the form of a thin slush, is passed to a third set of cascade cooling pans, where fans again assist in the solidification. As soon as the acid has set, the cakes are packed in shipping sacks holding 200 lb. of product.

The foregoing account is intended to give a clear, general idea of the processes and equipment that enter into the production of stearic acid and its byproducts. If it has succeeded, thanks are due to Messrs. E. W. Lynd and W. H. Shields, respectively vice-president and chemical director, for their very valuable assistance.



RUSSIA—*A Nation Starting Anew*

Basic chemical enterprise energetically fostered in comprehensive program of industrial growth

RUSSIA'S renascence did not make a spontaneous beginning, of course, when her leaders prophetically agreed, in 1928, that in a few specified years its rate must increase by a set of very precise and surprising leaps. Between the time of her turmoil in the closing war years and the first attempts at a systematized plan in 1926-27 the restive condition of the country was quietly active in turning the national ship with nose upstream, at first only holding her own, but finally making some headway too. And only when this headway became rapid enough to carry some momentum it appeared feasible to attend with greater concentration to the guidance and power behind it—now, however, with the prospect of attaining some ultimate destination.

The present organization of Russian chemical industry, like all Soviet state industries, is under the supervision and control of the Supreme Council of National Economy, which is a sort of ministry of industry. It functions through a department called the Glavkhim (Chief Chemical Committee), and the various producing groups are united into trusts.

By-products Plant in Donetz Coal Basin

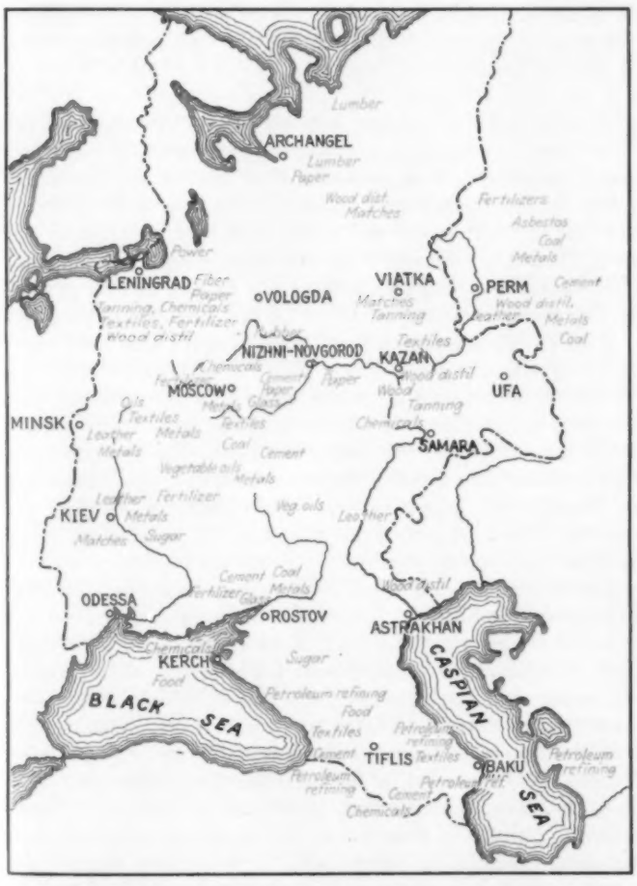
The so-called Five-Year Plan, now in effect, was evolved by the Supreme Economic Council after two others had soon become incommensurate with industry's needs. It was designed to cover the period from October, 1928, to October, 1933 (in accordance with the Soviet fiscal year), and worked out in all its intricacy on the basis of Russia's industrial growth in recent years and incidentally on the two inadequate discarded plans. A real self-sufficiency meant a real inter-dependence of products, most of which had not previously been made in Russia; in fact, this applied to some of the most vital chemicals before the War. An indication of this changed complexion of affairs is shown by the basic figures in Tables I and II.

Table I—Russian Production of Basic Chemicals in Significant Years
(Metric Tons)

	Acids	Alkali	Superphosphate
1913	309,000	.....	62,868
1921–22	50,000	46,200	5,000
1924–25	175,600	150,482	53,496
1925–26	236,300	199,634	91,808
1926–27	310,400	242,591	97,392
1927–28	350,000	284,777	151,392

Table II—Output of Principal Chemical Products under Supreme Economic Council, 1927-28

Basic Chemical Industry	Metric Tons
Acids, (Sulphuric, nitric, hydrochloric)	294,000
Superphosphates	170,000
Various Salts	175,000
Coal Tar	82,000
Crude Benzol	21,000
Ammonium Sulphate	13,000
Semi-refined organic products	5,700
Dyes	11,200
Drying Oil	8,000
Varnishes	4,500
Mineral Pigments	18,500
White Lead and White Zinc	12,200
Ultramarine	2,400
Acetic Acid 30 per cent	2,100
Rosin	2,100
Hydrogenated Fats	85,000
Household Soap	174,500
Cosmetics and Perfumery	8,700
Bone Glue	10,900
Toilet Soap, dozen cakes	17,800,000
Allied industries, rubber and matches, reported:	
Rubber Shoes, Pairs	39,915,000
Various Rubber Products, Metric Tons	43,900
Matches, Cases	5,320,000



Chemical Enterprises Under Construction in U.S.S.R., 1928-9

It is this trend that represents justification for the 30 billion dollars allotted to the Plan, the 11 billion going to the modernization of agriculture, the billion involved in exploiting petroleum and coal, and the 10 million for a synthetic ammonia plant alone.

Regarding the present progress of the systematically expanded chemical industries, the statistics given in Table III may serve as their own explanation. They represent investments for new construction, expansion and modernization, estimated at 1,367,100,000 rubles—an increase evident from the following prior figures:

1924–25	14,700,000 rubles
1925–26	48,310,000 rubles
1926–27	60,100,000 rubles
1927–28	80,800,000 rubles

A large part of the construction of new chemical plants is carried on through an organization called Khimstroy (the Chemical Plant Construction Bureau), while much of the imports for the industry is handled by still another organization, Khimimport (Chemical Imports). A large part of the marketing of the products of the various chemical producing organizations is concentrated in the hands of the All-Union Chemical Syndicate, which was organized about two years ago.

Vakhtan Naval Stores Plant

Table III—Russian Chemical Industry Under the Five-Year Plan

Industry	Construction Started	Construction Finished	Cost* (1 ruble = $0.50)
Four large chemical combines:			
Central Chemical Combine	1928/29	1932/33	60,000,000
Chernorechensky Plant Group	1928/29	1929/30	7,470,000
Chemical Plant, Beresniaki, Ural	1928/29	1931/32	3,000,000
Chemical Combine in connection with Khopersky Metallurgical Plant	1931/32	1934/35	22,000,000
Phosphates (23 plants and mills)	1928/29	1930/31	69,135,000
Sulphuric acid plants (6)	1928/29	1929/30	38,847,000
Magnesite and synthetic chalk (1 plant)	1929/30	1929/30	345,000
Caustic soda and sodium carbonate (7 plants)	1928/29	1931/32	58,300,000
Sodium sulphate (3 plants)	1928/29	1931/32	6,200,000
Potash mines and plants (4 groups)	1926/27	1933/34	32,050,000
Alum (1 plant)	1928/29	1929/30	700,000
Copper sulphate (2 plants)	1928/29	1930/31	780,000
Lithopone and titanium white (4 plants)	1930/31	1932/33	3,750,000
Ground colors (2 plants)	1929/30	1929/30	650,000
Colored earths (1 plant)	1931/32	1931/32	250,000
Ochre smelting (1 plant)	1929/30	1930/31	150,000
Zinc, Met. (1 plant)	1928/29	1929/30	7,000,000
Aluminum and alumina (1 plant)	1928/29	1929/30	360,000
Carbide (2 plants)	1931/32	1932/33	1,900,000
Iodine (3 plants)	1929/30	1932/33	2,400,000
Sulphur (1 plant)	1929/30	1931/32	1,500,000
Rare elements (1 establ.)	1928/29	1932/33	2,000,000
Wood distillation (16 plants)	1926/27	1932/33	39,595,000
Acetone (2 plants)	1930/31	1930/31	1,960,000
Raw turpentine extraction (17 plants)	1930/31	1932/33	8,369,000
Rosin extracting (12 plants)	1929/30	1931/32	29,400,000
Essential oils (2 plants)	1929/30	1931/32	970,000
Synthetic camphor (2 plants)	1928/29	1930/31	1,400,000
Lacquers and varnishes (4 plants)	1931/32	1931/32	4,370,000
Coke ovens (2 plants)	1927/28	1929/30	12,000,000
Tar distillation (3 plants)	1929/30	1932/33	6,000,000
Synthetic tar (1 plant)	1929/30	1929/30	175,000
Naphthalene and anthracene (2 plants)	1930/31	1931/32	2,000,000
Hydrogen recovery and motor fuel plant (one only)	1929/30	1931/32	5,000,000
Cerasine (ozokerite) (1 plant)	1930/31	1931/32	600,000
Bone reduction (leather, glue, etc.), (9 plants)	1930/31	1932/33	16,200,000
Soap (7 plants)	1926/27	1933/34	9,770,000
Waste candle recovery (1 plant)	1930/31	1932/33	3,500,000
Fats (2 plants)	1928/29	1933/34	3,575,000
Hydrogenating (1 plant)	1930/31	1931/32	4,000,000
Oil extraction from Soya beans (1 plant)	1931/32	1932/33	2,400,000
Rubber tires (2 plants)	1928/29	1930/31	64,000,000
Galalite (artificial horn) (1 plant)	1931/32	1932/33	500,000
Artificial fiber (3 plants)	1927/28	1929/30	33,700,000
Oil cloth and linoleum (2 plants)	1928/29	1929/30	5,100,000
Matches (8 plants)	1930/31	1932/33	20,930,000
Tartaric acid (1 plant)	1931/32	1932/33	350,000
Licorice (1 plant)	1929/30	1929/30	100,000

*(Figured at Prices of 1926-27)

A particularly interesting feature of the vast and variegated expansion, only roughly delineated in this brief sketch, is the invitation accorded by the Soviets to foreign intelligence, especially America. Technical-aid contracts to the number of over 30, call for industrial guidance on the part of American firms, who supply nothing further than the instructions and plans. And trained specialists, especially in chemical engineering and metallurgical lines, are enrolled individually to share both the expenditure and achievement entailed in the consummation, through their aid, of Russia's unique dream.

For the numerical and statistical data representing the substance of these pages, acknowledgment is due to Basil W. Delgass, Karl Dengg, and S. S. Shipman, all of the Amtorg Trading Corporation, New York.

Chemical Engineers at Asheville Discuss Cellulose Technology

Editorial Staff Report

WESTERN North Carolina extended a characteristic welcome to the two hundred chemical engineers and their guests who met in Grove Park Inn at Asheville, Dec. 2-4 for the twenty-second annual meeting of the American Institute of Chemical Engineers. Amid the pleasant surroundings of the famous resort, the meeting found a happy balance in its business, technical and social sessions. In keeping with the industrial environs, technical interest centered largely in cellulose technology—in particular, the chemical engineering problems of the pulp and paper, rayon and textile industries. R. W. Griffith, of the Champion Fibre Company, serving as chairman of an active local committee, provided an appropriate background of plant visits, in order that the visitors might receive first hand a more intimate picture of recent industrial advances in this growing section of the South. All of the plants so visited were briefly described in the last issue of *Chem. & Met.* (See pages 660-65, November, 1929.)

John D. Rue, engineer of the Newsprint Service Bureau, presided at the well-attended symposium on pulp and paper manufacture. Quite appropriately, the session started with a thorough-going review of current lines of chemical engineering research in pulp and paper now under way at the Forest Products Laboratory. C. C. Heritage, director of research for the Oxford Paper Company, presented a paper which had been prepared in co-operation with C. E. Curran, who succeeded him in his former position in charge of the pulp and paper section of the Forest Products Laboratory. Fundamental work in evaluating paper and pulp products and in obtaining increased knowledge of machine and processing variables has been followed by application and improved utilization in the paper mills. Seldom have such problems been attacked in a more comprehensive fashion, and the complete paper, which will be published shortly in *Chem. & Met.*, includes much of helpful and practical value to the industry.

The drying of pulp and paper was discussed from different aspects in two papers that had their origin in the work of the chemical engineering department of the Massachusetts Institute of Technology. Dr. T. K. Sherwood, assistant professor at Worcester Polytechnic Institute, presented a picture of the general mechanism of the drying of solids of various kinds and then showed how the same explanation was applicable to the drying of pulp and paper. F. W. Adams and C. M. Cooper, of the M. I. T. School of Chemical Engineering Practice, presented the results of a series of performance tests on a typical economizer installation used in the drying of pulp and paper.

Professor Sherwood showed that the drying operation is in general divisible into a constant rate period and a falling rate period. During the former the surface of the solid is wet with liquid and the rate of evaporation is not a function of the water content. The major factors affecting the rate of drying in this period are the air velocity past the surface, heat conduction from adjoining dry surfaces and radiation from the surroundings. During the falling rate period, the rate of drying falls off either because the wetted surface decreases or because the rate of internal liquid diffusion becomes controlling. In the latter case there is a tendency for evaporation to occur not at the surface but at points within the solid structure.

This same mechanism applies directly to pulp and paper. Internal liquid diffusion was shown to control throughout the falling-rate period in the case of thick pulp slabs. In the case of thin sheets of pulp and paper, the mechanism of drying during the falling-rate period is that of unsaturated drying.

CONSIDERING that it is necessary to evaporate between 1 and 3 lb. of water per pound of pulp and paper produced, it is apparent that heat is an important item in manufacturing costs. Adams and Cooper showed in their paper the various factors controlling the heat recovery efficiency of an economizer installation. The maximum heat recoverable for drying in this system is the sensible heat which can be put into the drying air—a relatively small fraction, being always less than one-third of the available heat. Tests showed this recovery in winter to be two or three times that in summer, due to the condensation of a considerable proportion of the moisture carried by the hot humid air. In the summer, condensation is of minor importance and a small increase in temperature causes a very slight decrease in heat recovery. In a hypothetical case for an installation on a 120-ton newsprint machine, the authors showed a conservative net saving of $7,980 per annum on an initial investment of $27,100 for the economizer and ducts.

C. L. Wagner, of the J. O. Ross Engineering Corporation, described the process and furnace for alkali recovery from soda and sulphate pulp liquors which he has now successfully developed after six years of experimentation involving a wide variety of chemical engineering problems. By means of a "scene-in-action" diagram, Mr. Wagner demonstrated the operations of a typical installation. Briefly it consists of a stationary vertical steel furnace, circular in form, with a refractory lining and a roof which is a water-wall extension of the boiler covering the furnace and gas passage to the water-tube boiler of special design. In action the furnace may be said to resemble a blast furnace in which the combustible gases produced in the lower part are burned in the upper part instead of being led away to burn otherwise. The most recently completed large installation of the Wagner furnace is at the Union Bag & Paper plant at Tacoma, Wash., where a five-unit system designed for 120 tons daily capacity has consistently exceeded this by from 10 to 20 per cent.

In opening the textile symposium on Dec. 3, the

chairman, Dr. Harrison E. Howe, expressed the opinion rather generally held by chemical engineers, that the textile industry has been particularly backward in its attitude toward chemical research and the application of modern chemical engineering methods. Each of the several speakers that followed emphasized the opportunity —if not the absolute need—for chemical engineers in the various branches of the industry. Prof. Albert H. Grimshaw, of the textile chemistry and dyeing department of North Carolina State College, presented the general picture of operations and equipment in the bleaching, finishing, and dyeing of cotton piece goods, pointing out specifically the relationship of the chemical engineer. C. Davis Blackwelder, in charge of chemical engineering operations for J. E. Sirrine & Company, Greenville, S. C., had prepared a paper on severe service problems in the bleaching of textiles, but was unable to be present.

Major interest in the symposium centered in the paper of Prof. Charles E. Mullin, of Clemson College, on recent developments in artificial fiber production and processing. He quickly disposed of the saturation bugaboo by showing that the world's production of artificial fibers is only about 3 per cent of that of natural fibers. The marked trend toward acetate silk was clearly indicated by the fact that more than forty such plants are under consideration or construction in various parts of the world at the present time. (The Waynesboro, Va., plant of the du Pont Rayon Company, is pictured on the contents page of this issue.—Editor.)

Of special interest to the chemical engineers was the recently announced Brandwood system of rayon production. This method, developed in England for use in the viscose process, eliminates a great many laborious and time-consuming operations. The freshly spun and untwisted viscose rayon is wound on a special large flanged bobbin of aluminum which has a perforated spindle. Then, by means of an apparatus resembling a package dyeing machine, the yarn while still wound on the spool is washed, desulphurized, bleached, soured, neutralized, dyed and sized, if desired, and finally dried before rewinding and twisting.

Professor Mullin referred also to the Lilienfeld viscose process now being developed, in order to produce yarn of exceptionally high strength. Still another development of peculiar interest to the chemical engineer is the work on a new cuprammonium silk being conducted by Drs. H. S. Miner and F. C. Nonamaker for the Welsbach Company at Gloucester, N. J.

That the natural silk industry likewise offers work for the chemical engineer was well brought out by Dr. W. F. Edwards, chief chemist of the United States Testing Laboratories, who reviewed the various operations in converting the raw material from the cocoon to the sheer transparency of milady's stockings. Only recently has this opportunity developed, for until the beginning of the present century the Japanese industry was scattered among some 400,000 households. Today, largely through American influence, the industry is gradually being concentrated in plants where modern methods can be applied.

WHAT is the textile industry's attitude toward chemical research and chemical engineering? Is it true that this industry has not kept pace with others in the application of chemical engineering methods, processes and equipment? The A. I. Ch. E. symposium at Asheville brought forth abundant evidence of the opportunity for the chemical engineer in practically every branch of the textile industry.

Robert H. Brown, of the Parks-Cramer Company, of Boston, presented a paper entitled "The Fundamental Principles of Air Conditioning in the Textile Industry." He cited the necessity for and reviewed the development of modern equipment and methods for humidity and temperature control in the plants in which textiles are processed.

Prof. Harry A. Curtis, of Yale University, received greatest acclaim for a concise and interesting presentation of a method he developed with R. L. Copson for disposing of kier liquor from a small Connecticut textile plant. This paper, which will be published in the next volume of *Chem. & Met.*, outlined an engineering investigation leading to a novel and comparatively inexpensive treatment of the waste product. Flue gas was used to reduce the alkalinity of the liquor and then, by the addition of calcium chloride solution, a precipitate of calcium carbonate is formed. In settling out, this removes 80 per cent of the color and most of the colloidal material. Practically all of the sodium salts are converted to NaCl, which is not undesirable in the effluent.

In the final technical session that preceded the business meeting of Dec. 4, Percy C. Kingsbury, chief engineer of the General Ceramics Company, presented a competent review of recent advances in chemical stoneware—more specifically, in solving the corrosion problems of the textile industry. He described the equipment lately installed in the new rayon plant of the American Enka Corporation for handling muriatic acid and sodium hypochlorite. The entire equipment—centrifugal pumps, piping, valves and storage vessels—is made of chemical ware. The storage equipment is unique in many respects. The HCl unit has a capacity of 10,500 gal. and is made up of 20 stoneware vessels, each of 525-gal. capacity. A second unit for sodium hypochlorite consists of 15 similar vessels and has a capacity of 7,900 gal. By siphon interconnections each system functions as a separate unit, permanent and practically foolproof. As the capacity can easily be increased, the system is extremely flexible. Storage vessels up to 1,600 gal. capacity have been made but there are hazards in handling a single piece of clayware of this size.

Prof. E. E. Randolph, head of the chemical engineering department at North Carolina State College, described the purification of waste liquors from a small city gas plant.

The final paper of the meeting was a discussion of the relative cooling rates of crystallizing and non-crystallizing rosin, by H. E. Nash and E. A. Georgi, of the experimental station of the Hercules Powder Company. By means of long-stemmed thermometers distributed in three layers throughout a barrel of rosin, they were able to learn considerable of the time-temperature relations existing within the barrels of crystallizing and non-crystallizing rosin and to explain the marked difference in the method and speed of cooling of the two materials.

EDITOR'S NOTE: An account of the annual business meeting will be found in the news pages of this issue.

When Should You Apply For a Patent?

By Louis Burgess
Patent Attorney, New York

ENGINEERS are frequently unable to decide whether a certain accomplishment constitutes invention and merits protection. This situation cannot be disposed of by the remark that they should consult a patent expert. Such procedure consumes time and money. The engineer should himself be qualified to dispose of a question which is certain to arise repeatedly in practice. In this way, he can substantially increase his own effectiveness and make greater progress. If acquainted with the few basic principles set forth in this article, he is in most cases the one best judge of the question.

MY PURPOSE in writing this article is to try to place the engineer in a position to determine which portions of his work warrant filing applications for patent. The question of whether or not any specific development constitutes invention is at times highly debatable, and the underlying principles cannot be enunciated with the clarity and precision which characterize mathematical or physical laws. Every case must, however, be eventually decided by applied reasoning that is essentially engineering. The engineer familiar with the specific field, who knows the basic considerations, can make a determination unsurpassed in point of accuracy, and at the same time eliminate the handicap of waiting for attorneys who are notoriously slow. This determination may shape the course of his experimental work or, if invention does exist, cause him to prepare evidence of the development that will maintain his rights.

Consideration of this subject will be facilitated by the definition of the term "inventor" and, by implication, the definition of invention. *An inventor is one who has created something which is neither expressed in, nor clearly inferable from, the prior art.*

The prior art which is to be used as a yardstick in determining this question consists of antecedent publications and patents of the wide world, and of antecedent usages, viz., the practices of artisans, craftsmen, engineers, etc.; in this country. Congress assumed that usages in foreign countries were so remote, difficult to prove, and susceptible of malproof or distortion, that they should not be used against a domestic inventor.

Determination of the question of invention implies, therefore, a knowledge of the prior art in the specific field. This should always be available: the engineer who starts research or development work in any important field without first collecting all prior patents and publications and acquainting himself with methods previously in use, is incompetent. He is wasting his time and the time and money of his associates or employers. He should provide himself initially with all this material and arrange to receive, during the progress of his work, all current publications and patents relating to it.

The subject can be best pursued from this point by a study of the methods by which the existence of or absence of invention must be determined in the last analysis. The ultimate decision as to the validity of a patent is made by a federal court; the primary determination is made in one of a large number of district courts; and appeals from this court are taken to one of several circuit courts of appeal. In exceptional cases, appeals from the circuit court may be taken to the Supreme Court of the United States. Determination in the district court is made by a single judge. During a trial before him the proponents of the invention litigated produce their patent and describe the advantages thereof. The opponents then produce as many similar things as they can discover in the prior patents, text-books, prior machines or practices, and argue that the patent contains nothing not shown in the references, or differs from the references merely in inconsequential details which could be supplied by any mechanic.

JUDGES who must decide this intrinsically difficult question on conflicting evidence are almost without exception members of the general bar, lacking even the rudiments of engineering training, and, with of course, no demonstrated aptitude for engineering matters. There are some judges who hold nearly every patent to be lacking in invention, and there are other judges who determine nearly every patent to be valid. Generally speaking, therefore, if a real question as to the existence of invention is present, the eventual determination may fall either way.

This brings me to the first rule with respect to the filing of applications. If there is any real question as to the existence or absence of invention, then file! The consequences of failure to file are apt to be much more serious and painful than the consequences of filing unnecessarily. If you fail to file, you may live to hear a court solemnly validate the invention which you rejected, and may even find that someone else has monopolized the field to your exclusion. If you file, you may subsequently find that the development is not nearly as inferable from the prior art as you first considered it and that it possesses marked advantages which you did not then

appreciate, so that its inventive character is more easily established at a later date. At the very worst, if you obtain a patent it may be highly valuable for trading purposes, because your competitors realize that, regardless of the facts, the final judgment of the court as to its validity *may* be favorable. It is of interest to know that the preceding recommendation is the established policy of every large corporation with extensive patent interests.

I have not overlooked the existence of the Patent Office, but the Patent Office is not equipped to determine the question of invention except in very clear cases. This is difficult to determine in any case where there is no opposition, and the Office has neither the time nor the personnel to do it accurately. Where there is any real question, it must presume that invention exists and leave the matter to be determined eventually in the courts.

ALL this applies with special force only to the class of developments in which the existence of invention is debatable; the work of the inventor frequently falls into either of the two additional classes: where invention is clearly absent, or where invention is clearly present. In order to make intelligent determinations, the engineer must be familiar with the methods which the courts apply in classifying claimed inventions. The only statute relating to the question provides that an invention to be patentable must be new and useful. The interpretation of this requirement by the courts is highly instructive. The courts are not interested in the intellectual processes of the "inventor" or the travail or ease by which his contribution was produced. They merely set the claimed invention up against the established background of prior art to determine whether the new is, in fact, clearly inferable from the old. If the new development is not inferable from the old, and has even a slight degree of usefulness, it is new and useful within the meaning of the statute and therefore patentable.

Selden patented the first automobile which was driven by a steam engine. The patent was in litigation in the case of Selden vs. Ford and the evidence showed that this automobile had never performed satisfactorily, but that on one occasion it had managed to travel for about a half mile. The court held that this was sufficient usefulness to sustain the patent and that the patent was therefore valid. Ford was held not to infringe, because the Ford automobile did not employ a steam engine.

On the other hand, if the thing claimed to be new is clearly inferable from the prior art, the usefulness is unimportant, as no degree of usefulness will make an invention when novelty is lacking.

Similarity or dissimilarity of the claimed invention to the prior art is not easily determined in most cases, and the question whether the new is clearly inferable from the old may present great intrinsic difficulty. In determining this question, the courts have established certain salutary rules of interpretation, for example, the prior art stands only for that which is clearly inferable from it by a person of ordinary intelligence familiar with the specific field.

In most cases the inventor has borrowed heavily from the prior art and a real question exists as to whether his accomplishment is clearly inferable from it. This may come about in a number of ways: for example, he may have taken an old process and made it successfully workable by eliminating certain steps previously considered necessary; alternately, he may have taken an old process and added certain steps to it, thereby making it successfully operable; again, he may have created success out of failure by merely modifying certain steps of an old process in particulars which, in retrospect, seem absurdly simple. In all these cases, it will be obvious that it is extremely difficult to determine whether the new is inferable from the old. Now that someone has made the inference and disclosed it to us, it is intellectually impossible to re-create the *status quo*.

In all these cases the court applies the fundamental test. Is a new and useful result secured? I am not now referring to that modicum of usefulness which must characterize an invention, but to the more fundamental question: Has a social want or necessity been satisfied? This usefulness may take a variety of forms; thus, it may reside in an increased efficiency, an extended utility, an increase in the field of application of a machine, or the development of a superior and more desirable product. To be sure, the result must still be a new result in the sense that it is not forecast by, or clearly inferable from the prior art; but this question is definitely deductible and demonstrable in contradistinction to the abstract question of whether the change in itself is inferable from the prior art. The result involved is not the immediate mechanical or chemical effect, but the satisfaction of some social or economic need. Generally speaking, the basic purpose of the patent law is, to encourage those changes which make things better or cheaper.

The decision in Diamond Rubber Co. vs. Consolidated Rubber Tire Co. 220 U. S. 428, is instructive. The patentee there concerned made a slight change from prior devices in the metal rim used on vehicle wheels. This change consisted in giving the walls of the metal rim, in which the rubber tire was sealed, an outward flare, so that when the carriage went around a corner the tire could partially roll out, and then automatically come back to its seat. The Supreme Court, referring to this device, said:

> The tire has utility, a utility that has secured an almost universal acceptance and employment of it as will subsequently appear. It was certainly not an exact repetition of the prior art and has been accepted as the termination of the struggle for a completely successful tire. It possesses such amount of change from the prior art as to have received the approval of the Patent Office, and is entitled to the presumption of invention which attaches to a patent. *Its simplicity should not blind us as to its character. Many things, and the patent law abounds in illustrations, seem obvious after they have been done and in the light of the accomplished result, it is so often a matter of wonder how they so long eluded the search of the discoverer and set at defiance the speculations of inventive genius. Pearl vs. Ocean Mills, Bann vs. Ard. 469, Fed. Case No. 10,876, 11 Off. Gaz. 2. Knowledge after the event is always easy, and problems once solved present no difficulties, indeed may be represented as never having had any and, expert witnesses may be brought forward to show that the new thing which seemed to have eluded the search of the world was always ready at hand and easy to be seen by merely skillful attention. But the law has other tests of invention than simple conjectures of what might have been seen and yet was not. It regards a change as evidence of novelty and utility of change as a further evidence even as demonstration.*

THE ENGINEER, in summary, should procure all available prior art before starting any important research or development program. Having procured this, he can in most cases determine immediately by comparison whether or not his developments are inventive in character. If they are, they should be authenticated with a view to filing patent applications. In doubtful cases, he must consider the antiquity of the references and the new and useful results flowing from the proposed change. With due regard to these principles his judgment should be equal or superior to that of any other person.

Producing Alumina by Acid and Electrothermal Processes

By Junius D. Edwards

AND

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SEARCH for a commercial process of extracting alumina from clay is frequently inspired by the thought that clay can be found anywhere and obtained at almost no cost. This, however, is an overly optimistic view of the situation. Clay contains, at best, but 30 to 40 per cent of alumina, and usually less, as compared with a 60 per cent alumina content for bauxite. Furthermore, the efficiency of alumina extraction is usually greater for bauxite than for clay.

Another reason for the interest in the utilization of clay for the production of alumina is that some countries which do not have adequate supplies of bauxite within their borders do have abundant clay deposits. In order to foster an aluminum industry, dependent for its raw supplies on domestic products, hundreds of possible processes for utilizing clay and ores other than bauxite have been investigated.

Because none of the so-called acid processes for the production of alumina has achieved any large commercial success, there is no single process which can be described as being typical in the way that the Bayer process is typical of the alkali digestion processes. In general, however, the acid processes involve the conversion of the aluminum compounds in the ore into aluminum salts, such as aluminum sulphate, chloride or nitrate, and the purification of such salt. When the aluminum salt has been prepared in suitably pure form, the next problem is to convert it into Al_2O_3 and recover the acid radical of the aluminum compound, for use in the process or in some salable form.

THIS *is the second of two articles by the authors, describing means for making alumina and the present status of the various processes. In the November issue the alkaline methods, typified by the Bayer process, were taken up. Acid processes, intended chiefly for producing alumina from materials other than bauxite, are discussed here. Here also the authors explain the electrothermal processes, of which the "Dry Process," developed by the Aluminum Company of America, is the most important.*

It was pointed out in the first article (*Chem. & Met.*, **36**, 1929, 674) that, in the case of the alkaline processes, iron in the aluminous ore causes practically no trouble, since ferric oxide is substantially insoluble in alkaline solutions. On the other hand, these processes may give trouble on account of the attack of silica by the alkali. For alkaline refining ore should be low in silica.

The case is the reverse when the acid processes are employed. These always dissolve more or less of the iron, but most of them do not dissolve the silica. Titanium is likely to be partly dissolved. Any gelatinous or colloidal silicic acid formed by acid attack on clay can be readily and quite completely removed, but the iron salts are so closely related to the aluminum salts in their chemical behavior that a complete separation is practically always difficult and expensive, and in most cases commercially impossible. From their nature, therefore, the acid processes are best adapted to the treatment of ores low in iron, such as kaolin, feldspar, alunite, leucite, or the comparatively rare deposits of white bauxite.

A typical series of operations which might be used in the production of alumina from clay is as follows: The clay, which may or may not have undergone a roasting operation to make the alumina more readily soluble, is digested in an acid solution. The use of sulphuric acid for this operation has many advantages, in that sulphuric acid is cheaper than hydrochloric or nitric acid and hence unavoidable losses do not place such a heavy charge on the process. The apparatus required for handling sulphuric acid is simpler and in general less expensive than that required for handling nitric and hydrochloric acid.

A solution containing about 60 per cent sulphuric acid seems to be satisfactory for this purpose. The finely ground clay and acid solution are heated together with agitation until the maximum quantity of alumina has been extracted. Depending upon the clay used and other conditions, varying amounts of iron, silica and titanium will have been extracted with the alumina, and the solution of aluminum sulphate probably will require further purification before a sufficiently pure aluminum sulphate can be prepared from it. A variety of procedures have been proposed for this purpose but none has been entirely satisfactory, partly because the iron in the product must be very low. Alumina for electrolytic reduction should not have more than about 0.05 per cent Fe_2O_3.

This article, in greatly condensed and somewhat modified form, is taken from the forthcoming book, "The Aluminum Industry," by J. D. Edwards, F. C. Frary and Zay Jeffries, which is being published by the McGraw-Hill Book Company.

After purification, the solution is then concentrated by evaporation and the aluminum sulphate recovered in solid form. The next step might involve the drying of the aluminum sulphate preparatory to its calcination. The calcination process has for its object the decomposition of the aluminum sulphate into pure alumina and

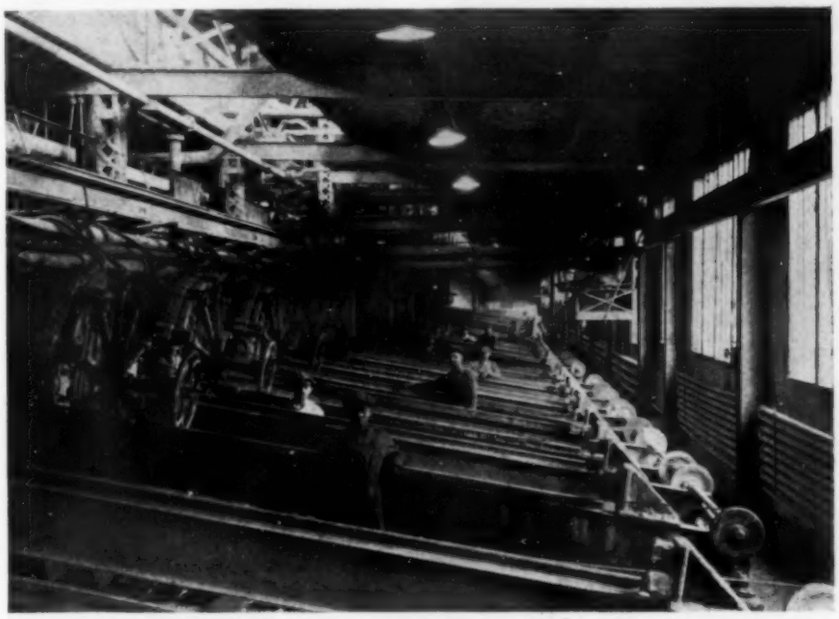


Fig. 1—Bayer Process; Kelly Type Filter Presses Are Used in Separating the "Red Mud" After Digestion of the Bauxite With Caustic Soda

gaseous oxides of sulphur. The gaseous oxides of sulphur are then recovered in the form of sulphuric acid for use in the next cycle of the process. This is much easier said than done: the temperature required for complete decomposition of the sulphate is about 1,000 deg. C., and it is therefore difficult and expensive to calcine in any way except by direct heating, as in a rotary kiln. Such heating, however, involves mixing so much air and products of combustion with the sulphur dioxide that the chamber or contact space required for the formation and condensation of the sulphuric acid becomes excessively large and expensive, making the recovery of dubious economic value.

Other acids, such as hydrochloric, nitric and hydrofluoric, can be used for the extraction instead of sulphuric acid. The Blanc process, for example, utilizes hydrochloric or nitric acid for the extraction of alumina from leucite (see Fig. 2). The successful operation of this process depends to a large extent on the fact that in the leucite found in the neighborhood of Rome and Naples the leucite occurs in rather large phenocrysts, and the gangue is magnetic and can be removed by a magnetic separator. Baron Blanc has found that if the leaching of leucite concentrates with hydrochloric acid is carried out by percolation without disturbing the porous mass, the silica will remain in place when the solution is drawn off. The commercial possibilities of the process depend upon the recovery of potassium salts as well as alumina.

The variations possible in the operation of the acid processes for the extraction of alumina seem to be much more numerous than in the case of the alkaline processes, largely because of the variety of acids which may be employed and the multiplicity of methods available for the removal of impurities such as iron. An outline of the typical operations in acid processes is given in Fig. 4.

Electrothermal Processes

Besides the processes already covered, there is a group in which the first and characteristiv step involves the use of high temperature, generally in an electric furnace. In the simplest of these processes the impurities are reduced to the metallic state and separated from the alumina; other processes convert the alumina into such compounds as aluminum nitride, carbide, chloride and sulphide.

While the chemical methods heretofore described, in so far as they have been successful, extract the alumina in aqueous solution and might be said to aim primarily at the production of a pure aluminum salt solution, by extracting the alumina from the ore and leaving most or all of the impurities insoluble, the electrothermal or "dry processes" proceed in the opposite direction by reducing the impurities to the metallic state and separating them from the molten pure alumina.

The simplicity of this type of process

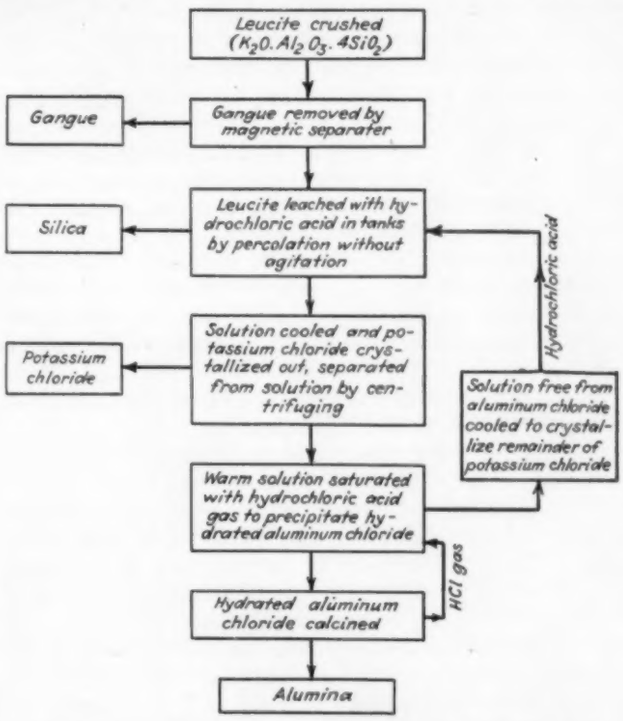

Leucite crushed ($K_2O.Al_2O_3.4SiO_2$)
Gangue
Gangue removed by magnetic separater
Silica
Leucite leached with hydrochloric acid in tanks by percolation without agitation
Hydrochloric acid
Potassium chloride
Solution cooled and potassium chloride crystallized out, separated from solution by centrifuging
Solution free from aluminum chloride cooled to crystallize remainder of potassium chloride
Warm solution saturated with hydrochloric acid gas to precipitate hydrated aluminum chloride
HCl gas
Hydrated aluminum chloride calcined
Alumina

Fig. 2—Blanc Process, Operated in Italy on Leucite Found in the Neighborhood of Rome and Naples

first appealed to Charles M. Hall (Hall, C. M., U. S. Pats. 677,207, 677,208, 677,209, June 25, 1901; 706,553, Aug. 12, 1902); and he and his company (Pittsburgh Reduction Company) spent several years and a large sum of money in unsuccessful pioneer attempts to commercialize it. They were, however, unable to secure a sufficiently complete purification of the alumina for commercial purposes, and also unable to make the fused alumina behave

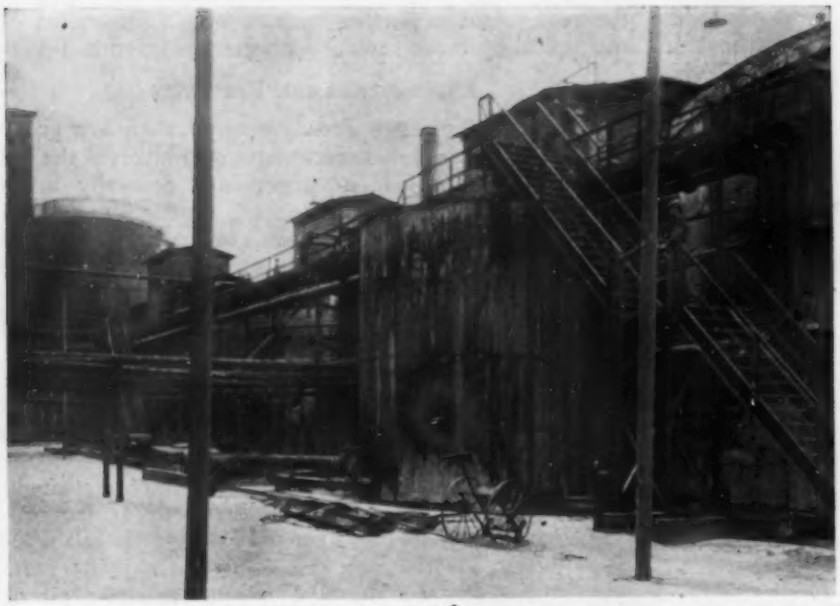


Fig. 3—Bayer Process; Aluminum Hydrate Is Concentrated and Washed in These Tanks

properly in the electrolytic cells, so they were compelled to abandon it. However, a quarter of a century later their successors (Aluminum Company of America) solved both these problems and put the process into commercial operation. (Frary, F. C., U. S. Pat. 1,534,031, April 21, 1925; Can. Pat. 256,131, Dec. 8, 1925; Fr. Pat. 600,146, Jan. 30, 1926; Horsfield, B. T., Br. Pat. 248,360, Apr. 21, 1927; Fr. Pat. 622,313, May 28, 1927; Br. Pat. 262,405, Jan. 19, 1928; Fr. Pat. 622,313; 1st Add., 32,581, Feb. 14, 1928.)

It is known that, in the interval, other aluminum companies had experimented with this process and in turn abandoned it. And although many other inventors had proposed modifications of Hall's original process, and an extensive artificial abrasive industry (using fused alumina of 94-98 per cent purity) had developed on the basis of Hall's pioneer work, no one had previously been able commercially to produce aluminum from dry process alumina.

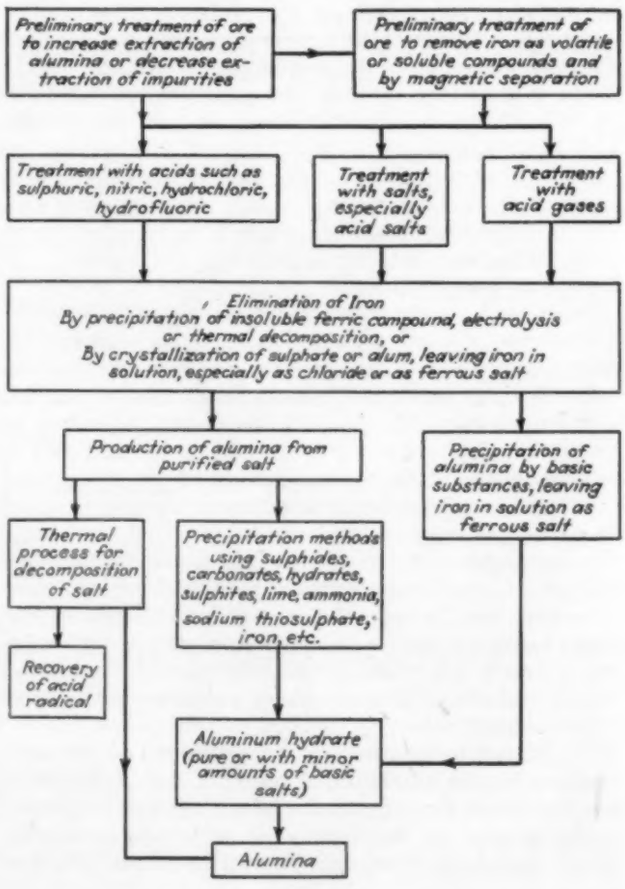
In the operation of the process (Fig. 6) a mixture of ferruginous and siliceous bauxites, containing the proper proportions of iron, silicon and titanium, is first sintered to remove water. There must be iron and silicon enough present to dissolve all the titanium after reduction and permit it to be tapped out as a ferro-silicon-aluminum-titanium alloy. The sinter is then smelted in an electric furnace with the proper amount of coke to reduce all of the impurities and a little of the alumina. When 5 to 10 tons of molten purified alumina has been formed in the furnace, overlying a layer of the molten alloy containing the impurities, the furnace is tilted and the superheated molten alumina poured off, at a temperature which is probably about 2,500 deg. C. The alloy is later tapped out on the other side of the furnace.

The molten alumina may be cast into large blocks and subsequently crushed and ground to pass an 80-mesh screen, but a preferable procedure is to blow it into small hollow globules by the impact of a jet of high-pressure air or steam. In this process the stream of molten alumina, as it issues from the tapping spout, meets the high-pressure blast from a nozzle located just below the spout. The alumina is blown into fragments which are in the form of hollow globules ranging in size from very fine sand to $\frac{1}{8}$ in. or $\frac{3}{16}$ in. or more, with cellular walls which as a rule do not exceed 0.01 in. in thickness and in most cases are much thinner.

A part of the iron oxide remaining in the molten alumina is volatilized during the blowing operation, and all of the carbon and dissolved carbide are oxidized. If the velocity of the blast is too low, the larger globules may not be as completely oxidized as when a higher velocity is used, and may contain larger amounts of iron and carbon. These larger globules are black in color, whereas the well-blown material is snow-white. It is well known that by blowing blast furnace slag there is produced a fibrous material commercially known as slag wool. This seems to be due to the viscous characteristics of silicate slags. However, when alumina substantially free from silica is blown in this way, there are produced the hollow globules just described.

The process is preferably completed by a leaching operation, in which the globular or pulverized alumina is treated with dilute acid and washed to remove the lime (0.2 to 0.7 per cent, derived partly from the coke ash and partly from the bauxite) and about half of the remaining oxides of iron, silicon and titanium. It is desirable to remove the lime because it accumulates in

Fig. 4—Outline of Typical Operations for Making Alumina by Acid Processes


Preliminary treatment of ore to increase extraction of alumina or decrease extraction of impurities
Preliminary treatment of ore to remove iron as volatile or soluble compounds and by magnetic separation
Treatment with acids such as sulphuric, nitric, hydrochloric, hydrofluoric
Treatment with salts, especially acid salts
Treatment with acid gases
Elimination of Iron
By precipitation of insoluble ferric compound, electrolysis or thermal decomposition, or
By crystallization of sulphate or alum, leaving iron in solution, especially as chloride or as ferrous salt
Production of alumina from purified salt
Precipitation of alumina by basic substances, leaving iron in solution as ferrous salt
Thermal process for decomposition of salt
Precipitation methods using sulphides, carbonates, hydrates, sulphites, lime, ammonia, sodium thiosulphate, iron, etc.
Recovery of acid radical
Aluminum hydrate (pure or with minor amounts of basic salts)
Alumina

the electrolyte during the reduction process, and of course, the oxides of iron, silicon and titanium are reduced with the alumina and contaminate the metal produced. As an example of the effect of leaching, ground alumina slag having an aluminum oxide content of 98.87 per cent was treated with a 10 per cent solution of sulphuric acid for 20 hours. After digestion and washing, the purity of the alumina was increased to 99.75 per cent. The digestion removed 60 to 65 per cent of the oxides of iron, silicon and titanium present, and substantially all of the lime. The resulting aluminum oxide is pure enough to produce commercially aluminum of 99.2 per cent purity.

The most important modification of the above-described "dry process" is that due to Haglund (Haglund, T. R., U. S. Pat. 1,569,483, Jan. 12, 1926; Reissue 17,001, June 19, 1928; Br. Pats. 232,549, Nov. 26, 1925; 234,830, Dec. 17, 1925; 289,639, May 3, 1928; 295,227, Aug. 2, 1928). This is now under development on a semi-commercial scale by the Vereinigte Aluminium Werke, at its plant in Lauta, Germany. The central idea of this modification is the reduction of the furnace temperature by lowering the fusing point of alumina.

For this purpose FeS_2 (e.g., pyrites) is included in the charge and sufficient carbon is employed to reduce all of the oxide impurities and an appreciable portion of the alumina. The alloy obtained is similar to that of the Aluminum company's dry process, except for a high sulphur content, but the molten alumina contains 10 to 40 per cent of aluminum sulphide, which reduces the melting point of the slag at least 500 deg. C. Upon solidification, the aluminum oxide forms minute, transparent crystals imbedded in a matrix of aluminum sulphide. To recover the alumina, the sulphide matrix is decomposed by water, steam, chlorine, or hydrochloric acid; the hydrogen sulphide produced is recovered as iron sulphide by absorption in ferruginous bauxite.

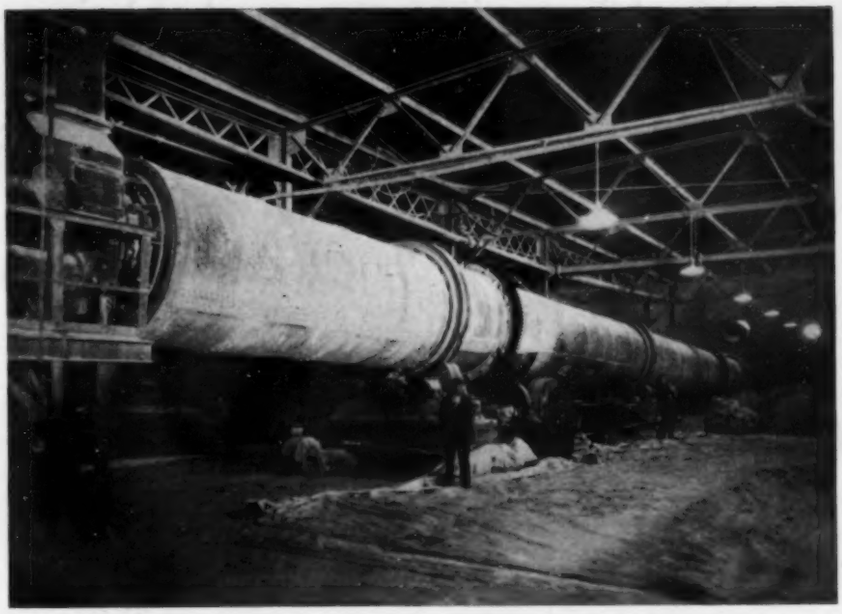
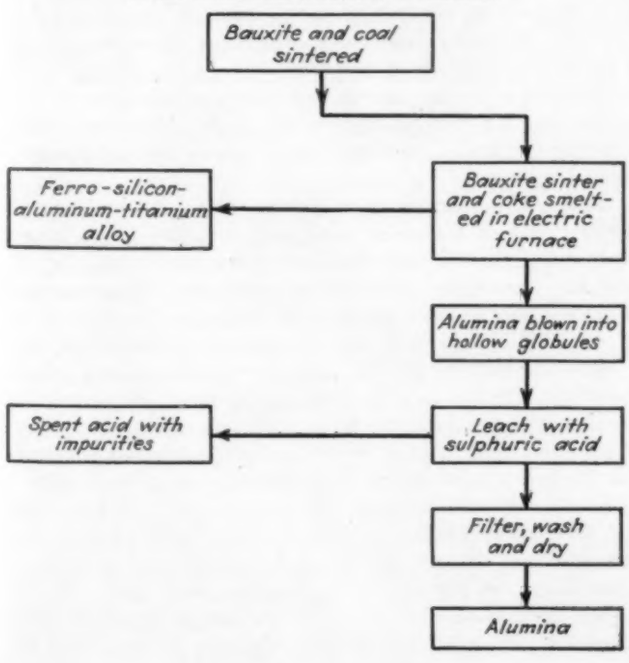


Fig. 5—Bayer Process; Concentrated and Washed Aluminum Hydrate is Calcined in Large Rotary Kilns

Another electrothermal process on which a good deal of time and money has been spent is the so-called "nitride process," best represented by the Serpek development. In this process, bauxite, mixed with carbon, is heated in a current of nitrogen to a high temperature in an electric furnace, with the formation of aluminum nitride. The aluminum nitride can be decomposed by digestion with caustic soda, with the resultant formation of ammonia and sodium aluminate, from which the alumina is recovered. While excellent in theory, the nitride process has failed to materialize into a successful commercial process. The formation of the aluminum nitride has proved to be a difficult operation on a commercial scale. Furthermore, its subsequent decomposition by caustic soda represents a number of problems not met with in the digestion of bauxite with caustic soda.

With the hundreds and hundreds of patented processes for the production of alumina, it would seem as if almost every useful procedure had been described. Undoubtedly further progress will be made in lessening the cost of producing alumina, but workers contemplating research in this field would do well to consider the very voluminous patent literature, in order to take advantage of work already carried out in this field, and to avoid repeating the mistakes of other investigators.

Fig. 6—Flow Diagram of Operations in the "Dry Process" of the Aluminum Company of America


Bauxite and coal sintered
Bauxite sinter and coke smelted in electric furnace
Ferro-silicon-aluminum-titanium alloy
Alumina blown into hollow globules
Leach with sulphuric acid
Spent acid with impurities
Filter, wash and dry
Alumina

Calcium Sulphate Deposits in Equipment

Working jointly with the University of Nevada, at Reno, the Bureau of Mines has developed a method for removing deposits of calcium sulphate from inaccessible parts of solution circuits. It is pointed out that, particularly in various lixiviation processes, hot solutions containing even small quantities of lime will react with sulphates present to form troublesome $CaSO_4$ deposits in equipment. Reaction of the coating with hot sodium bicarbonate solution is found to soften the scale so it can be flushed out of the system. Weak HCl solution will remove any remaining scale completley.

Fundamental Principles in Air Conditioning

By Claude A. Bulkeley

Chief Engineer, Niagara Blower Company, Buffalo, N. Y.

COMMERCIAL AIR CONDITIONING is a comparatively new field of endeavor. As it is now understood and applied to manufacturing processes and in furtherance of human comfort, its entire development, method of application, and control have come about during the past 25 or 30 years. As air conditioning is so new, even those who were first to start work in the field are still actively engaged. Perhaps this accounts for the fact that there is little literature available and no engineering handbooks on the subject have been published.

Air conditioning is an exact science, and as such lends itself to accurate results. The effects of air conditions on human comfort and health are now well known and the research laboratory of the American Society of Heating and Ventilating Engineers, at Pittsburgh, has collected accurate data and established standards for the conditioning of air. These standards leave no doubt as to the requirements for both health and comfort,—requirements which can readily be met by suitable air conditioning equipment.

Neither should any uncertainty obtain as to what air conditioning will do for process operations when the air temperature and humidity requirements of the process or material have been determined, by experiment or otherwise. With proper attention to the type and capacity of equipment any special condition can be met exactly. In many industries air conditioning is already an economic necessity, as an aid to production, control of quality, or protection against loss of material.

AIR CONDITIONING embraces the reducing of air to constant and more or less interrelated characteristics. It concerns the temperature and moisture content of air as well as the quantity of foreign particles, such as dust, which are always present in the atmosphere.

Air, regardless of where it is found, always contains water vapor, and the amount of this moisture, correlated to the temperature, is the most vital matter in air conditioning. The reason for this lies in the fact that temperature and moisture conditions of the atmosphere exert a strong influence upon the cellular materials encountered in so many forms of manufacture. And even where the materials processed are not cellular in character, man is always present with his capacity for reacting very definitely to the condition of the air.

Such terms as actual humidity, relative humidity, and temperature of the air are generally understood, but since they are of such vital importance in connection with air conditioning, brief definitions with examples will be given. Actual humidity is the weight of water vapor contained in 1 cu.ft. of the mixture of air and vapor and is usually expressed in grains of water per cubic foot. Air temperature is ordinarily considered as the indication of a thermometer having its bulb dry and exposed to the air. Relative humidity is a factor related to the air temperature. It is the ratio of the actual humidity (grains of moisture per cubic foot) in the air at a given temperature to the number of grains of moisture the air would hold if saturated at this same temperature. It is expressed in percentage. Air is saturated when it contains all the moisture it will hold without fog appearing. For example, air containing 5.67 grains per cubic foot at a temperature of 70 deg. F. has a relative humidity of 70 per cent since saturated air at 70 deg. contains 8.1 grains per cubic foot.

ALL CELLULAR MATERIAL has hygroscopic characteristics; that is it absorbs and gives off moisture, depending on the moisture content and temperature of the air. The amount of moisture contained in materials greatly affects their physical and sometimes chemical, characteristics. In general, any hygroscopic material assumes its peculiar and varying characteristic qualities with regard to such functions as weight, strength, elasticity and pliability, depending upon the relative humidity of the air rather than air temperature. In the case of certain crystalline substances, as with candy, temperature may be as important as the amount of moisture in the air. In other cases the temperature may bring about chemical changes in a material.

Furthermore, air having low relative humidity is most favorable for the generation of static electricity where friction occurs in the handling of materials as in manufacturing and using paper.

When the relative humidity is 60 to 70 per cent or more, little or no static electricity is created. In many industries, this is important since the attraction and repulsion caused by static often interfere with processes. Further, in the photograph film industry the light from a static discharge will ruin sensitized undeveloped film.

In conditioning air we find certain limitations which, however, are not usually disadvantageous. For example, it is never practical to have 100 per cent relative humidity without having more or less entrained moisture in the air, appearing in the form of fog. Even during a heavy rain, the outdoor air usually lacks a few per cent of saturation (100 per cent relative humidity). Only on a foggy, drizzly day does the outside air ever reach maximum or 100 per cent relative humidity. At the other end of the scale it is also practically impossible, even by chemically processing the air, to have 0.0 per

Note: The English units of feet, pounds, grains, B.t.u. and Fahrenheit temperature are used here with but one exception, viz., vapor pressure in mm. of mercury. Although the author personally prefers the C.G.S. system, all data, formulas, and apparatus are based on the English units, making it impracticable to treat the subject otherwise.

cent relative humidity. Outside air on no portion of the earth's surface ever has less than about 10 per cent relative humidity.

What is known as the dew point of air is another factor having a direct bearing on air conditioning. It is the temperature in degrees at which air of definite moisture content would be saturated. In a concrete example, air of 50 deg. dew point is air which, if cooled from an initially higher temperature to 50 deg., is then saturated with moisture and has a relative humidity of 100 per cent. If we heat saturated air, without adding any moisture, even a very small amount above the saturation or dew point temperature, it will then have a corresponding relative humidity of less than 100 per cent. Cool air below the dew point temperature and moisture will begin to condense. A homely example, of course, is the formation of dew at night when the earth's surface has been cooled by radiation or other causes to a temperature which is lower than the saturation or dew point temperature of the immediately adjacent air. When this occurs the moisture in excess of saturation is forced to condense in the form of dew. Analogous to this is the deposit of moisture on the outside of a pitcher of ice water in summer, when the surface temperature is below the dew point of the adjacent air.

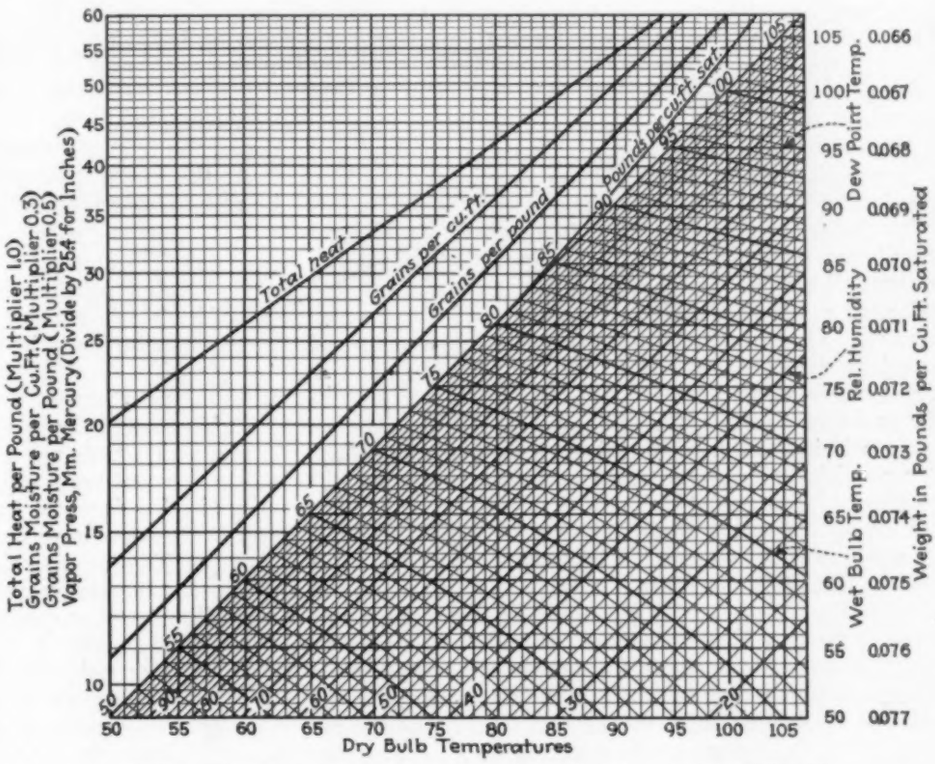
Since control of relative humidity is the most important factor in air conditioning, and since it is dependent both on dew point and dry bulb temperature, both must be definitely controlled for a constant desired temperature condition. If constant temperature conditions are not necessary, the proper relation between dew point and temperature of the air must still be maintained.

For example, if a constant inside temperature of 70 deg. and 60 per cent relative humidity is required, a dew point temperature of 55.4 deg. must be maintained. If the dew point remains constant at 55.4 deg. and the temperature rises to 75 deg., the relative humidity will fall to almost 50 per cent. On the other hand, let it be assumed that a varying inside temperature is allowable, with a constant relative humidity of 60 per cent. Table I then shows the relation of necessary dew point to dry bulb temperature.

In Table I it is evident that, if the dew point of the supply air be an uncontrolled variable, the inside dry bulb temperature must be con-

Table I—Relation of Dry Bulb and Dew Point Temperatures for Constant Relative Humidity

Dry Bulb Temperature, Deg.	Dew Point Temperature, Deg.	Relative Humidity Per Cent
70.56	56	60
72.68	58	60
74.80	60	60
76.92	62	60
79.04	64	60
81.18	66	60
83.30	68	60
85.44	70	60
87.56	72	60
89.70	74	60
91.84	76	60
93.98	78	60


Total Heat per Pound (Multiplier 1.0)
Grains Moisture per Cu.Ft. (Multiplier 0.3)
Grains Moisture per Pound (Multiplier 0.5)
Vapor Press, Mm. Mercury (Divide by 25.4 for Inches)
Total heat
Grains per cu.ft.
Grains per pound
Pounds per cu.ft. sat.
Dry Bulb Temperatures
Dew Point Temp.
Rel. Humidity
Wet Bulb Temp.
Weight in Pounds per Cu.Ft. Saturated

Bulkeley Psychrometric Chart for Temperatures From 50 to 105 Deg. F.

This psychrometric chart was prepared by the author while he was connected with the engineering department of E. I. duPont de Nemours & Company. It was designed to give greater accuracy in air conditioning as applied to indoor work. For temperatures below 50 deg. and above 100 deg. F. the reader is referred to the Bulkeley psychrometric chart published by the American Society of Heating & Ventilating Engineers, 29 West 39th St., New York.

The construction of the chart is as follows: The straight diagonal line from the lower left to the upper right corner is called the saturation line, and is a plot of vapor pressure of water in mm. of mercury vs. temperature. Its ordinates are the figures at the left margin plotted against degrees F. temperature at the bottom as abscissas. The horizontal lines to right of saturation line are dew point lines. The lines parallel to and below the saturation line are per cent relative humidity. The lines curved downward at right of saturation line are wet bulb temperature lines. Wet bulb temperature is that indicated by an ordinary thermometer having its bulb covered with thoroughly moistened fabric exposed to an air velocity of not less than 1,200 ft. per minute. All vertical lines are dry bulb temperature. The wet bulb, dry bulb and dew point lines cross at saturation.

The lines above the saturation line are indices for the various functions shown and are read at a point vertically above the proper point on the chart. For example, the total heat index line is always used by running vertically from the intersection of the wet bulb and saturation lines, reading the amount of total heat at the left margin. An example will make the use of the chart clearer. Assume a case with temperatures of 95 deg. dry bulb and 75 deg. wet bulb. The dew point and relative humidity are read where the dry and wet bulb lines cross and are found to be 66.6 deg. dew point and 39.6 per cent relative humidity. Running in a vertical direction from the intersection of the wet bulb and saturation lines to the total heat index line, we read the total heat at the left as 37.8 B.t.u. per lb. of dry air. Running in a vertical direction from the dew point of 66.6 deg. at the saturation line to the grains-per-lb. index line, we read grains of moisture per pound of dry air at left of chart as 19.6 × 5 = 98. The grains of moisture per cubic foot at a dew point of 66.6 deg. is read in the same manner as 24.1 × 0.3 = 7.23. This figure, however, is for constant volume, assuming no volume change in heating the air from 66.6 deg. to 95 deg. Since in air conditioning the volume must increase in proportion to the absolute temperature rise, the grains of moisture per cu.ft. must be decreased in this proportion. The correction gives (526.2 ÷ 554.6) × 7.23 equals 6.86 grains of moisture per cu.ft.

Note that the index line for pounds per cubic feet of saturated air is coincident with the saturation line below 80 deg. The pounds per cubic foot at a dew point of 66.6 deg. is therefore read as 0.07368 at right margin. This also assumes constant volume conditions and is subject to the same absolute temperature noted above.

The total heat given on this chart represents B.t.u.'s absorbed in heating 1 lb. of dry air saturated with moisture from 0.0 deg. F. to the selected temperature, and in heating and vaporizing the moisture content.

trolled with relation to the changing dew point. This is not difficult to do if the air conditioning system is properly designed.

Conversely, if the inside dry bulb temperature be an uncontrolled variable, then it is necessary to control the dew point with relation to the changing inside temperature. This can be done, though it usually requires refrigeration or cold well water to control the dew point during the summer season.

Again, if constant inside temperature and constant relative humidity should both be required, then both inside temperature and dew point must be controlled, and this usually requires refrigeration in summer.

Another set of conditions may require varying relative humidity. This can be obtained by readjustment of the controls, manually or automatically, provided the system is properly designed. Either the dry bulb or the dew point temperatures or both may be varied to gain this end.

Now that the conditioning of air has been discussed in a general way, it is desirable to examine briefly how the desired results are to be attained.

The most satisfactory method is to supply air properly distributed to the space to be conditioned, first passing it through air conditioning apparatus, consisting principally of a spray chamber wherein are located spray nozzles. These nozzles deliver the necessary amount of atomized water under pump pressure in such quantity and manner as to obtain so intimate a contact between the moisture and air that both leave the spray chamber at or within 1 deg. of the same temperature. When this condition obtains, the air leaving the apparatus will be practically saturated or within 1 deg. of its dew point.

Leaving the spray chamber, the air passes through eliminators which consist of zig-zag baffles that whip out the entrained moisture. From the eliminators the air (within 1 deg. of saturation) is usually drawn through some type of steam-heating coil by a fan which distributes the air properly throughout the room, either with or without distributing duct work, as may be required. Anywhere from 90 per cent to none of the air supplied to the room may be returned to the apparatus, the deficiency being drawn from the outside. The proper ratio between recirculated and fresh air is usually maintained under automatic control, and varies with either inside or outside conditions or the relation between the two, as well as with requirements of the installation.

IF THE temperature of the spray water is kept constant by heating or cooling, as the case may be, the dew point of the air will remain constant on leaving the spray chamber. With air having a constant dew point delivered into the room, it remains only to control the room temperature to maintain constant relative humidity, which latter is ordinarily the vital factor wherever air conditioning is required.

Incidentally, when the air washer or water spray chamber is properly designed to secure saturation of the air passing through, practically all objectionable foreign particles of dust and dirt (and often odors) will be washed out of the air, with much the same effect as obtains out of doors on a bright morning after a rain.

During the fall, winter and spring seasons the dew point of air leaving the spray chamber may be controlled by mixing fresh, cool air from outside in proper proportions with recirculated air from the room. The air will leave the chamber at the dew point necessary to maintain the correct relative humidity for a minimum temperature of, say, 70 deg. inside. This mixing of fresh and recirculated air is under automatic control. Where a greater quantity of fresh, cold air than is necessary to maintain correct dew point must be supplied to the room, the deficiency in heat is provided under automatic control by heating the spray water, usually with steam. If comparatively low inside temperature is to be maintained in summer (10 to 20 deg. F. below the outside temperature), mechanical refrigeration or cold water is usually employed to maintain the dew point necessary for the required relative humidity.

PERHAPS it is well to draw attention to the fact that relative humidity varies inversely (though not in proportion) as the interval between dew point and room or dry bulb temperature. For example, with 80 deg. temperature and 70 deg. dew point (an interval of 10 deg.), the relative humidity is 71.3 per cent. With 80 deg. temperature and 50 deg. dew point (interval of 30 deg.), the relative humidity is 35 per cent.

At this stage a summary of the conditions that may be met in controlling relative humidity will be helpful:

1. If constant room temperature must be maintained
   (*a*) To maintain a constant relative humidity, the dew point must be kept constant.
   (*b*) To increase the relative humidity, the dew point must be raised.
   (*c*) To decrease the relative humidity, the dew point must be lowered.
2. If constant dew point is to be maintained
   (*a*) To maintain a constant relative humidity, the room temperature must remain constant.
   (*b*) To increase the relative humidity, the room temperature must be lowered.
   (*c*) To decrease the relative humidity, the room temperature must be raised.
3. With varying room temperature
   (*a*) To maintain a constant relative humidity, the dew point must vary directly and in almost equal amount with the room temperature.
   (*b*) To increase the relative humidity, the interval between dew point and room temperature must be decreased.
   (*c*) To decrease the relative humidity, the interval between dew point and temperature must be increased.
4. With varying dew point temperature
   (*a*) To maintain a constant relative humidity, the room temperature must vary directly and in almost equal amount with the dew point.
   (*b*) To increase the relative humidity, the interval between room temperature and dew point must be decreased.
   (*c*) To decrease the relative humidity, the interval between room temperature and dew point must be increased.

On every air conditioning job all functional changes except starting and stopping must be under automatic temperature or relative humidity control, or a combination of the two. Manual control of air conditioning equipment is out of the question and completely impractical; in fact, the success of any installation is so dependent on the control that the selection of the correct combination of types of instruments particularly suited to the requirements of each kind of job is a very vital factor. Suitable control instruments are so perfect in performing their various functions that little and often no attendance is required for months or even years.

Calculation of Tanks For High Temperature and Pressure

By Joseph Kaye Wood

Consulting Engineer, New York

In the October issue of this magazine Mr. Wood showed that the "creep limit" is the proper criterion for predicting the strength of metals for use at high temperatures and pressures. In that article he developed a formula for tank design, which in the present article is expanded into the form of a line chart to permit the easy calculation of a large number of tanks. The author also has something to say about tank weight.

ALTHOUGH the formulas used in the design of large oil containers are rather simple, there are many important factors that control their use when the containers or tanks are to be used under high pressures and temperatures and under severe corrosive influences. In such cases it is always desirable to have some systematic method of calculation that will allow easy manipulation of the various factors in accordance with the numerous requirements. It is the purpose of this article to provide such a method and to describe the various requirements which affect these calculations.

In oil cracking, tanks perhaps 40 ft. long and 10 ft. in diameter are required to withstand rupture under pressures as high as 600 lb. and temperatures as high as 950 deg. F. In addition we must contend with the severe corrosive action of sulphur-containing oils. In a previous article the writer pointed out (*Chem. & Met.*, **36**, 1929, 610) that the circumferential tension in the tank wall is the maximum actual stress in the entire tank provided the elliptical type of head, equal to or greater in thickness than the cylindrical wall, is used. The formula giving the value of the circumferential stress is as follows:

$$S_a = \frac{PD}{2t} \qquad (1)$$

in which S_a is the maximum actual stress in pounds per square inch due to the internal pressure, P, also in pounds per square inch. D is the internal diameter of the tank and t the thickness of the cylindrical wall, both in inches.

The maximum actual stress, S_a, resulting from the internal pressure should be equal to the maximum stress which the tank metal can safely withstand under the imposed conditions of temperature and corrosion. According to the article previously mentioned, the safe maximum stress, S_w, is expressed as follows:

$$S_w = \frac{e}{100\,f}\ C.\ L. \qquad (2)$$

in which $C.\ L.$ is the creep limit of the tank metal, f is the factor of safety and e is the per cent efficiency of the welded joints in the tanks, usually taken as 90 per cent.

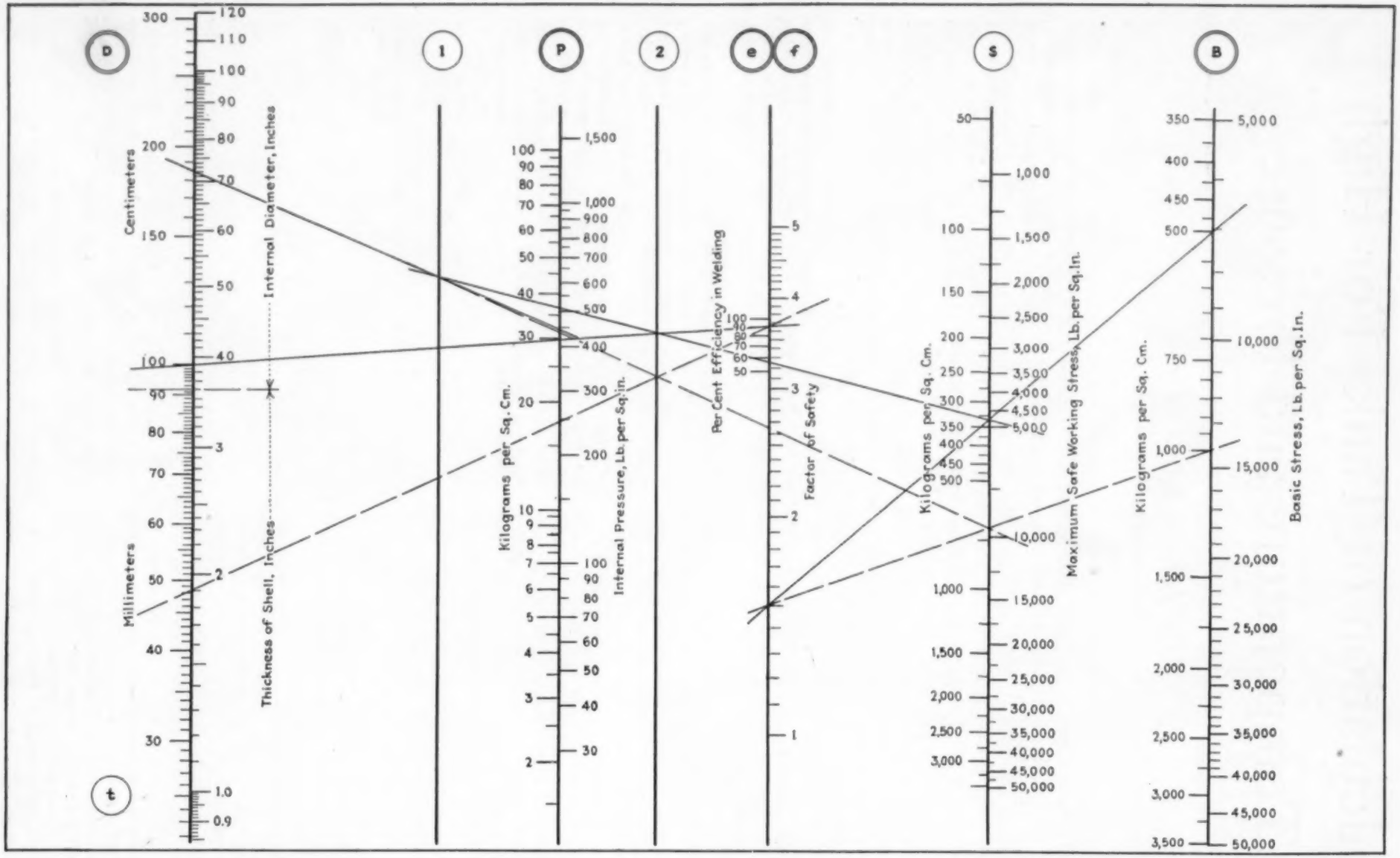
The creep limit of a metal is that maximum stress which, if sustained 1,000 hours at a given temperature, will cause no appreciable creep. The factor of safety, when basing the maximum safe stress upon the creep limit as defined here, may be given a value of 1.5 and may even be as small as 1.25 if the creep limit be based upon a test in which the specimen is brought up to temperature in a bath of the same oil used in the oil cracking process.

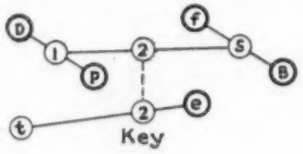
The word "appreciable" is used here in much the same sense as it is used in connection with permanent set when determining the elastic limit of a material.

When a maximum safe working stress, S_w, has not been established by virtue of long standardized practice, it is the general custom to derive this figure from some basic physical property easily determined in the testing laboratory. The basic property is divided by a factor of safety (allowance being made for the efficiency, e, of the welded joints) whose value depends more or less upon the degree to which the laboratory test conditions differ from actual conditions in service; and upon such unknown factors as accuracy of interpretation of actual service conditions and in calculating the maximum actual stress, S_a. The accuracy in determining S_w depends therefore upon the technician's skill in duplicating actual service conditions in the laboratory, thereby cutting down the required factor of safety. It depends also upon a human process bordering on instinctively good judgment based upon long experience and mere guesswork. Use of the creep limit as the basic physical property, particularly when it is determined by a test using representative oil as the heating medium, leaves relatively little to guesswork and hence requires but a low factor of safety.

Having once determined the maximum safe working stress by the method outlined above, we have simply to place its value equal to S_a for the determination of the limiting tank dimensions. If S_a be made equal to S_w, then safety and economy in design results. If S_a be made smaller than S_w, safety without economy results; while if S_a be larger than S_w, then apparent economy results, but without safety. We may therefore equate S_a as expressed in formula 1 to the value of S_w as expressed in formula 2:

$$\frac{PD}{2t} = \frac{e}{100\,f}\ C.\ L.$$





A Line Chart for Pressure Tank Calculations

Note that each scale is given in English and metric units and that each is marked with a symbol designating one of the variables of tank design. Those symbols shown in a double circle are the ones ordinarily known, and those in a single circle are usually those to be determined.

To calculate a tank, given the following: a basic stress property of the material of the tank, such as the creep limit, scale *B*; the factor of safety, scale *f*; the welding efficiency, scale *e*; maximum working pressure, scale *P*; and internal diameter of the tank, scale *D*, place a straightedge to intersect values of *B* and *f*, marking intersection on *S*, the safe working stress. Place straightedge to intersect the values of *D* and *P*, marking intersection on scale 1. Connect intersection marks on 1 and *S*, marking intersection on scale 2. The straight line through *e* and 2 then intersects *t* at the required thickness of the tank.

and since we shall be interested particularly in t, we have:

$$t = \frac{PD}{2C.\ L.} \times \frac{100f}{e} \qquad (3)$$

This is the formula proposed for the design of large tanks to be used in oil cracking and similar processes, provided elliptical heads of plate thickness equal to or greater than that of the cylindrical wall are used.

Although formula 3 does not call for any considerable computation for a single determination, the writer has found from experience gained in the design and investigation of many large tanks for the oil industry that a line chart such as that shown on the opposite page is a great aid and time-saver when many determinations involving considerable manipulation of the terms must be made within a short time.

Each line of the chart has a symbol at the top which designates its respective scale. The line at the extreme left designated at the top by the symbol D also has the symbol t at the bottom because this line carries both the tank diameter and the plate thickness scales. All scales are expressed in both the English and metric units. To use the chart the key in the lower left-hand corner is followed. A straightedge is so placed that its ruling edge passes through given values on scales f and B. The intersected value on scale S is noted or marked. The straightedge is then placed with its edge passing through the marked value on the S scale and a similarly marked value on scale one, the latter having been obtained from given values on scales D and P in the same manner that S was obtained. The intersected value on scale 2 is then used as a pivot to obtain connecting values on scales e and t. This procedure may be varied from the particular order just given provided the key is followed. This shows that points on scales 1, 2 and S act as pivots. It is to be noted that the two small circles containing the figure 2 on the key diagram represent the same point or value on scale 2, the key being drawn in this manner merely for simplicity of arrangement.

Users of the chart may readily demonstrate to their own satisfaction that considerable ease and speed may be attained in manipulating the terms of formula 3, varying the respective values at will. Problems in tank design are worked out below to illustrate the use of the chart and incidentally to demonstrate how other factors such as corrosion may be taken care of in the design.

A Typical Problem

ASSUME a tank whose cylindrical length (exclusive of heads) is 40 ft. with an internal diameter of 6 ft. The tank is to be used at a maximum working pressure of 450 lb. per square inch and temperature of 900 deg. F. What will be the safe and economical plate thickness in this case?

The proper approach to all problems of design is to ascertain first all facts concerning the materials available, because upon the capacity of the material to withstand the imposed conditions depends the proper proportioning of the object being designed. In the particular problem stated here the two materials shown in Tables I and II were available to the writer:

Table I.—Low-Carbon Firebox Steel (Annealed)

Chemical analysis: Carbon, 0.12; Phosphorus, 0.022; Sulphur, 0.034; Manganese, 0.47; Copper, trace

Ultimate tensile strength at room temperature (68 deg. F.), lb. per sq. in.	49,500
Ultimate tensile strength at 900 deg. F., lb. per sq. in.	24,950
Yield point at room temperature (68 deg. F.), lb. per sq. in.	31,300
Yield point at 900 deg. F., lb. per sq. in.	16,400
Creep limit at 900 deg. F., for 1,000 hours, lb. per sq. in.	7,000
Per cent elongation at room temperature (68 deg. F.)	28
Per cent elongation at 900 deg. F.	40

Table II.—Special Vanadium Steel (Annealed)

Chemica analysis: Carbon, 0.19; Vanadium, 0.17; Phosphorus, 0.016; Sulphur 0.019; Manganese, 0.48; Silicon, 0.016; Nickel, 0.06

Ultimate tensile strength at room temperature (75 deg. F.), lb. per sq. in.	63,000
Ultimate tensile strength at 900 deg. F., lb. per sq. in.	44,000
Yield point at room temperature (75 deg. F.), lb. per sq. in.	42,500
Yield point at 900 deg. F., lb. per sq. in.	22,500
Creep limit at 900 deg. F. for 1,000 hours, lb. per sq. in.	14,000
Per cent elongation at room temperature (75 deg. F.)	40
Per cent elongation at 900 deg. F.	42

If we base safe maximum stress on the creep limit, the solution for t by means of the chart proceeds in the following manner: With firebox steel selected as the plate metal, a straightedge is placed on the chart so that its edge passes through the creep limit stress of 7,000 lb. per square inch on scale B and a factor of safety of 1.5 on scale f. The intersection on scale S is marked. Likewise, with the straightedge placed so as to pass through an internal tank diameter of 72 in. on scale D and a pressure of 450 lb. per square inch on scale P, the intersection on line 1 is marked. Thereupon the straightedge is placed so that it passes through the intersection marks on lines S and 1, and the resulting intersection is marked on line 2. Pivoting the straightedge on the latter mark and passing it through 90 per cent weld efficiency on scale e, we find the required thickness to be almost 4 in. at the intersection of the straightedge on a prolongation of scale t. In connection with the use of scales t and D it should be stated that in the prolongation of scale t beyond 3.6 in., the scale reading shown (on the diameter scale) is to be divided by 10. The opposite is the case in the prolongation of the D scale below 36 in., i.e., the scale reading is multiplied by 10. The straightedge positions in the solution of this problem are marked by unbroken lines on the chart.

IN A similar manner it is found that a thickness of practically 2 in. is required when the vanadium steel is used. It was obvious before determining this solution that a plate thickness of exactly half that obtained when the firebox steel was assumed would be obtained, because the respective values of the creep limits were in this ratio. The straightedge positions in this solution are marked by broken lines on the chart.

It is sometimes the custom to add about $\frac{1}{4}$ in. to the calculated plate thickness as an allowance for corrosion. Hence, for the firebox steel tank, the required thickness would be $4\frac{1}{4}$ in. and for the vanadium steel, $2\frac{1}{4}$ in. Recalculating by means of the chart on the basis of these modified plate thicknesses, we find a revised factor of safety for the firebox steel tank equal to 1.69, while for the vanadium steel tank a revised factor of safety equal to 1.59 is obtained. Thus, during the early use of the tanks, the tank made of vanadium steel would be more economical from the stress standpoint than that made of firebox steel.

The question of corrosion has been given considerable thought recently and in certain cases protective coatings such as aluminum paint have been applied to the interior of tanks. The real solution of this phase of the problem can be brought about only by research, the aim of which would be to produce a low or moderately priced metal having a relatively high creep limit at maximum service temperatures produced by baths of the same oil used in the cracking process. Once we have these data for a variety of metals we are in a position to make an intelligent selection for a given service without allowing for corrosion.

It would be interesting and instructive from the safety standpoint to solve the problem given above by the present standard or codified method in which the ultimate

tensile strength at room temperature is used as the basic stress along with a factor of safety of 5. Using the chart we obtain a plate thickness of $1\frac{7}{8}$ in. for the firebox steel, and a thickness of almost $1\frac{1}{2}$ in. is obtained for the vanadium steel. According to the proposed creep limit method, a thickness of $1\frac{7}{8}$ in. of firebox steel plate would, under the conditions of the same problem (and using the chart again), mean that the tank would have to operate under no factor of safety. In fact, it would have to operate under what might be termed a factor of "unsafety" equal to 1.42. Similarly, by the same method, a thickness of $1\frac{1}{2}$ in. of vanadium steel plate would mean a factor of safety equal to only 1.12. Now, since it would be very difficult to argue away the obvious correctness of the creep limit method as against the ultimate tensile strength method, it must be concluded that the latter method is far from safe and unsound from an engineering standpoint.

IT WOULD BE instructive from the safety standpoint to solve the same problem by the yield point method, in which the yield point at the service temperature (in this case 900 deg. F.) is used as the basic stress with a factor of safety of 2.5. Accordingly, from the chart we obtain a plate thickness of $2\frac{7}{8}$ in. for the firebox steel and a thickness of $2\frac{1}{8}$ in. for the vanadium steel. Using these thicknesses to calculate by chart the respective factors of safety based upon the creep limit method, we will discover that the tank made of firebox steel has a factor of safety of only 1.08, while the tank made of vanadium steel has a factor of safety of 1.59. In this case the yield point method gives unsafe results for firebox steel but practically the same results as the creep limit method for the vanadium steel. Since in certain instances, therefore, the yield point method is unsafe, its use should be discouraged. Use of a general factor of safety greater than 2.5 in the latter method would not help matters, because in other instances when such materials as the vanadium steel quoted were used, this method would become highly uneconomical. This assumes, of course, that the creep limit method is taken as the criterion, as the writer feels is proper.

A satisfactory degree of accuracy in calculated results may be obtained when using the line chart. For example, the solutions marked on the chart which were obtained with merely ordinary care, give the following comparisons:

	Value of t, Calculated	Value of t, by Chart	Per Cent Error
Firebox steel	3.86	3.90	1.0
Vanadium steel	1.93	1.90	1.5

It may be said, therefore, that with ordinary care in manipulation the line chart will give results that are within 1 or 2 per cent of being correct. In actual design, of course, a plate thickness of 4 in. for the firebox steel and 2 in. for the vanadium steel would be specified for the solutions given above.

Weight of Tanks Is Important

THE WEIGHT of the tank usually is estimated by the designer, either for the purpose of computing the probable cost or to permit design of the tank supports. Bulk also is a factor worthy of consideration, since in cases of extreme size, equipment presents a shipping problem.

Assuming the use of elliptical heads, we may use the following exact formula to compute the weight of cylindrical tanks:

$$\text{Total Weight} = \pi t \left[D\left(l + 3D + \frac{4b}{3}\right) + t\left(l + \frac{4b}{3}\right) - \left(\frac{d_x^2}{4} + \frac{d_y^2}{4} + \ldots . \frac{d_n^2}{4}\right)\right] \delta + \text{Weight of connections} \quad (4)$$

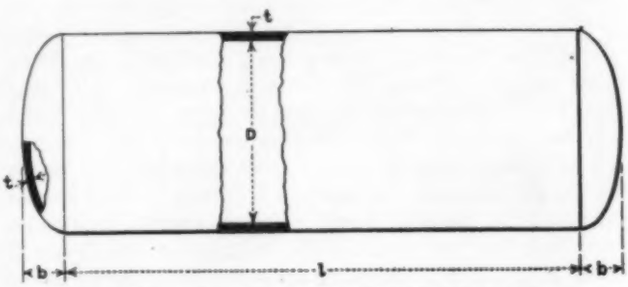
in which the symbols designate the following (see the drawing below):

D = Internal diameter of tank in inches
l = Length of cylindrical portion of tank in inches
b = Length or minor semi-axis of elliptic head in inches
t = Thickness of tank plate in inches
$d_x, d_y \ldots . d_n$ are the diameters in inches of holes in tank for receiving connections
δ = Lb. per cubic inch, density of tank material; for all kinds of steel it may be taken equal to 0.283 lb. per cubic inch

Since the above formula is more exact than may be required for a mere preliminary estimate of the weight, the following formula for large-size steel tanks is given, the error of which is well within a maximum limit of minus 10 per cent:

$$\text{Approximate Weight} = 0.889\, tD\,(l + 3D) \quad (5)$$

For the problem previously quoted the approximate



Tank Dimensions Involved in Weight Calculations

weight, assuming the vanadium steel is used, is computed as follows:

$$\text{Approximate Weight} = 0.889 \times 2 \times 72(480 + 216) = 89{,}100 \text{ lb.}$$

which is from 5 to 10 per cent lower than the exact weight as computed by the more comprehensive formula 4.

It might be asked why a line chart is not provided for the computation of weights. The construction of such a chart would be justified were it not for the fact that the computation of weights is made only about once for every 10 or 20 computations of dimensions. Furthermore, in the more exact formula 4 there are several items which do not permit the construction of a permanent form of chart, and this, after all, is the basic justification for short cut methods of computation.

In conclusion I wish to place particular emphasis on the necessity for proper welding of large-size tanks for high temperature and pressure service. Carelessness in the welding operation cannot be tolerated at any time, because it requires a poorly welded section of only a fraction of an inch in the total of, say, 1,500 in. of joints in a large tank to cause ultimate rupture. Allowance in a matter of this kind, such as reducing the welding efficiency, cannot be made during the design stage. The welding efficiency factor covers only the natural strength of a flawless welded section. A flaw in metal, which may be defined as a void, appreciably greater in size than the natural atomic spacing, can be repaired only by remelting.

READERS' VIEWS AND COMMENTS

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Gaseous Ammonia for Superphosphate

To the Editor of Chem. & Met.:

Sir:—In your October issue R. S. McBride published an article on ammoniating phosphate, on which I should like to comment because it seems to lack some significant and interesting information regarding products. The use of liquor ammonia may be a new factor in fertilizer materials, but the use of ammonia gas has been suggested since 1867 by Way, England, and was the subject of 35 patents up to 1908, at which time I did considerable work on this.

The phosphate rock used and the acid phosphate and double superphosphate treated were:

Pebble Phosphate Rock	Per Cent	Acid Phosphate Per Cent		Double Superphosphate Per Cent
Insoluble	9.58	16.2	Water-Soluble P_2O_5	37.3
Silica	8.50	0.83	Citrate Soluble P_2O_5	2.11
Iron oxide, Alumina	2.10	17.03	Total available P_2O_5	39.4
P_2O_5	32.08	0.19	Insoluble P_2O_5	1.35
CaO	35.0	10.55	H_2O (at 105°C.)	15.8

After ammoniating with ammonia gas there resulted:

Acid Phosphate Per Cent		Double Superphosphate Per Cent		
0.4	Water soluble P_2O_5	34.8	37.0	34.5
8.0	Citrate soluble P_2O_5	9.3	9.0	9.2
8.4	Total available P_2O_5	44.1	46.0	43.7
7.5	Insoluble P_2O_5	2.4	2.8	3.7
6.7	Ammonia (N_3)	8.3	7.4	7.8
10.5	H_2O	10.2	6.5	7.5
	Potash $-(K_2O)$	5.7	2.7	0.0

Calculated for moisture content of 6% =

Before Ammoniating Per Cent		After Ammoniating Per Cent
16.3	Water soluble P_2O_5	10.3
0.7	Citrate soluble P_2O_5	6.6
17.0	Total available P_2O_5	16.9
0.2	Insoluble P_2O_5	0.4
6.1	Moisture (H_2O)	4.85

After 30 days air exposure the moisture content was 4.2% and ammonia content 6.4%, showing no loss of ammonia.

From these analytical results we find that wet acid phosphate when ammoniated reverts the P_2O_5 to insoluble form owing to a reaction between $CaSO_4$ and $(NH_3)H_2PO_4$ or $(NH_3)_2HPO_4$. But when dried to 6 per cent ± water and then ammoniated, the reaction does not occur owing to lack of water. Neither does it revert on standing or exposure or storage. To me this partly explains the curious fact that ammoniation never formerly reached commercial conditions. The prevailing opinion in the patents is that the P_2O_5 reverted to the insoluble form. This compared to the ammoniation of disodium phosphate, a wet uncommercial material, gives in every case a merchantable form and not any reversion to the insoluble P_2O_5. If there is any reversion it is entirely in proportion or ratio to the $CaSO_4$ present. The above analysis shows that potash salts do not interfere in any way.

I would also say that the proportion of nitrogen and total available P_2O_5 is consistent. Absolutely chemically pure materials were used, cleaned from any free P_2O_5, and then ammoniated. This product was studied and there was found to be a triple combination, such as monocalcium mono-ammonium phosphate existent as a single salt. Details cannot be submitted owing to lack of space but I am willing to enter into correspondence about them.

In the interest of the trade generally it should be stated that there are no valid patents preventing American manufacturers from making ammoniated acid or double superphosphate. There is evidence for this.

34 Waverly St.,
Ottawa, Ontario,
Canada.

MAX M. HALE.

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Comparative Economies of Coke and Electric Furnace

To the Editor of Chem. & Met.:

Sir:—I wish to comment on the very interesting article, "Electrothermal Production of Phosphoric Acid," by Bethune G. Klugh, which appeared in your November issue, and especially the comparison, which this article makes, of the thermal efficiency of coke in the blast furnace with the thermal efficiency of electric current in the electric furnace.

Mr. Klugh speaks of an energy requirement, per pound of P_2O_5, within the blast furnace charge, as calculated in a "modified balance," as 3.085 lb. of carbon (as coke). Unfortunately, the article does not include a table giving the details of this "modified balance" and it is impossible, therefore, to determine how this figure was obtained. However, from the figures of thermal equivalents of coke and of electric energy, as given in Mr. Klugh's article, certain comparisons can be made which will show more clearly the relative theoretical values of coke and electric energy in these furnace processes.

Accepting, for the moment, Mr. Klugh's assumption that the only heat value derived from carbon in the blast furnace is that obtained by the combustion to CO, and calculating coke as 90 per cent carbon, a pound of coke would yield 3954 B.t.u., while in the electric furnace, 1 kw.-hr. delivers 3411 B.t.u. It is obvious, therefore, from these thermal equivalents, that a cost of $3.25 per ton of coke would require a cost for the electric current of 1.40 mills per kilowatt hour, to achieve the same cost per unit of heat. Such a price for electric power is lower than is generally available.

There is a further factor which has not entered into Mr. Klugh's considerations of the blast furnace process, and that is the recovery of the remaining heat value of the carbon changed, by the oxidation of the CO in the gas leaving the furnace, to CO_2. It is common blast furnace practice to burn all the CO from the furnace to CO_2, to recover part of the heat units so obtained in regenerators (stoves), returning these to the furnace in the form of hot blast and utilizing the remainder of the heat units from the combustion in the production of steam or for power. For a proper comparison of the blast furnace with the electric furnace method, the heat units so obtained should be considered. This would seem especially important because, according to Mr. Klugh, such recovery is not now an accomplished fact with the electric furnace process, and, at best, such recovery could

be only a fraction of the heat value recoverable from the blast furnace process. In view of these considerations, it is difficult to understand how a conclusion on economic inferiority of the blast furnace process for the production of phosphoric acid is warranted.

After all, these considerations merely bear out the accepted fact that the direct application of heat produced from fuel, as in the case of the blast furnace, is more economical than the indirect application of such heat through the cycle of steam and electric power generation.

August Kochs.
President,
Victor Chemical Works,
Chicago, Ill.

* * * *

The Case for Technical Aluminum Chloride

To the Editor of Chem. & Met.:

Sir:—Your November issue contains a very stimulating communication from M. H. Haertel on the subject of aluminum chloride, where comparison is made between the product described earlier by Dr. McAfee and the colorless material produced, for example, at Niagara Falls.

There is much in Dr. Haertel's letter that requires elucidation, particularly the implications regarding the rigorous requirements of the dye industry. Although limiting the discussion to the real issue—viz., the suitability of the new product in the dye industry—it appears advisable first to dispose of the references regarding containers and market quotations, which, I think, can be reliably ascertained by the user.

In his own connection with the dye industry, very personal relations would constrain the writer to take up the defense of the refined product, but the results of a very comprehensive investigation show that such a position is untenable. Technical $AlCl_3$ has a real and important place in the dye industry, despite the fact that it appears to be handicapped by its color and impurities. Discussion of this subject is indeed academic, for at this moment it is being utilized in large quantities in this field. In the vat color field in particular it enters into the Friedel-Crafts reaction for the preparation of anthraquinone and its derivatives.

It has been objected that the technical product is granular and not powdery. This constitutes not a drawback but an advantage. This physical state causes a comparatively slow absorption of atmospheric moisture while being handled, whereas the powdery material is spontaneously hygroscopic. In works practice it is, therefore, not only possible to add the granular product to the reaction vessel under milder operating conditions but it can be done more rapidly, as it flows more readily through the charging apparatus. The advantages of granulation cannot be discounted when there is a problem of maintaining the $AlCl_3$ anhydrous in storage and use.

In discussing the purity of technical $AlCl_3$ it is necessary to consider the true nature of the extraneous constituents. Ferric chloride is a good condensing agent, though not quite as active as the aluminum halide; but in certain condensations where a more moderate reaction is desirable the iron salt is indeed advantageous. The two impurities are found not only to assist in maintaining an anhydrous condition but are further found to be of distinct value in obtaining high yields and purity. This anomaly is accounted for by the great tendency, in the Friedel-Crafts reaction for keto acids, to the formation of impurities known as phthalides. These are caused largely by lack of homogeneity of the reaction mass and by excessive temperatures during the first part of the operation; in fact, it has been found advisable in a number of such condensations deliberately to slow up the reaction in its early stages. When the refined $AlCl_3$ is used the reaction often starts before the ingredients are thoroughly mixed, and consequently there is a rise in temperature and the lurking danger of phthalide formation. The presence of iron and silicon chlorides, along with the granulated condition of the technical product, combine to delay the reaction until the charge has been first mixed and then brought to the optimum operating temperature.

It can be shown also that the technical product behaves like the refined material in other respects so that the apparent advantages in price can be translated into pocketbook reality. The keto acids obtained on hydrolysis are all practically insoluble in acids and soluble in dilute ammonia and metal alkali solutions; but the catalyst, aluminum chloride and its iron and silicon impurities, behave in a reverse manner. It is, therefore, a very simple proposition in the course of operations to free the keto acids of all three halides. Tabulated data relating to phenyl-anthraquinone investigations, which are to be reported in the near future, will show that when a slightly greater excess of the technical $AlCl_3$ is used, the results are equal to those obtained with refined material.

There will remain always a constant need for the refined product. It is of invaluable assistance in carrying out new research where the necessity of making color observations must not be obscured by impurities in the reagents used. It requires no prophetic vision, however, to predict that the new technical aluminum chloride will gradually but inevitably be adopted on a large scale for the preparation of vat colors.

P. H. Groggins.
Washington, D. C.

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Writing Science Without "Scientese"

To the Editor of Chem. & Met.:

Sir:—In a recent number of *Chem. & Met.* James H. Collins wrote entertainingly on "How to Write in English Without 'English'." In reference to the new "International Critical Tables" may I offer the hope that some day these will appear in a translation from the present Scientese into some commonly used tongue such as English?

What brought this particularly to my attention was an attempt to use the specific heat data (or as we must now learn to call it, "heat capacity") as published in Vol. V of "International Critical Tables." I fortunately happened to start with a simple table, that of the heat capacity of water at various temperatures (p. 113, Vol. V). There is an introductory note that "C_p is in joules per gram," followed immediately by the information that "the values in the table should be increased by 0.12 per cent to bring them into accord with the I.C.T. accepted value of the joule which is 4.185 cal." Being unused to Scientese this statement troubled me. In the first place I had a dim memory that in the Dark Ages we used to convert joules roughly (but quickly) into calories by dividing by 4.2, whereas the note seemed to imply multiplication. Later research developed the fact that there

was a misprint and that it was intended to say that 1 cal. = 4.185 joules, but if the table had been anything but one concerning water, with which one expects heat capacities of around unity, when expressed in calories, it might have been like the traditional error in the *Materia Medica*, where many patients died of a misprint.

However, apart from first having to clear up the mystery of the relative sizes of joules and calories, I received a psychic insult from the fact that before one could use this apparently carefully prepared table, every figure must be increased by 0.12 per cent. And after that, if one is using calories, divide by 4.185. Finally, I plunged into a bewildering maze of figures concerning metals and alloys expressed in joules per gram, in joules per gram-mole, and some with no heading. The joules per mole, of course, require two divisions and constant reference to the atomic weight table. But the once convenient calorie is completely in discard.

Is it necessary to abandon common measures in order to make a noise like a scientist and am I merely a mid-Victorian survival? DONALD M. LIDDELL.

Chemical Engineer,
New York.

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Writing With "English"

To the Editor of Chem. & Met.:

Sir:—The article by Mr. Collins in your October issue on "Writing Without 'English'" is so entertainingly written, that, following his own principles, one shrinks to apply the knife of critical dissection to the body beneath the finery. A few incisions, however, made with this restraint in mind, should prove not too harmful if the body is otherwise healthy and sound.

Disregarding the dubious premise that the public-at-large "needs to know about science," one can readily agree that the engineer becomes more articulate as his poise increases and self-consciousness fades. But that this change should involve a helpless capitulation to the jargon of the street that Mr. Collins seems to endorse (and naturally avoids) would be to couple the engineer's technical knowledge and resourcefulness with a strange bed fellow. For, once you've discounted purely specific and personal inability, there is nothing more mysterious or perplexing about learning standard grammatic usage than about grasping the normal technical and professional equipment of every engineer. In fact, looking at the post-War "literary" market, one often suspects that the office boy or family cook will presently be slipping his printed impressions over on the public; hoboes and cab-drivers, after all, do contribute to *The American Mercury*.

And of course grammatic rules and "English" are justified by the same reasoning that upholds our vast body of scientific theories and laws. That is, they are helpful; intelligible communication is a matter of quite universal importance and its rules comprise the conventional skeleton of its functioning. The language itself may be riddled with logical faults, but so long as everyone accepts them consistently, no injury is done. Let the language, then, be learned along fundamental lines, and it will soon become a most valuable and unobtrusive tool in writing. You don't notice the handle particularly, but without it you get a pretty uncomfortable hammer.

To introduce Dr. McAfee and Dr. Teeple as witnesses is to show most strikingly what can be achieved when "English" has become second nature. In the face of innumerable similar examples among chemical engineers, why all the pother and pettishness and Easy-English-for-Engineers books about so simple a matter? If you would help the prospective "English" victim, instruct him in the situation that he is obliged to face, and not in its pointless evasions. He may soon be expected to possess a worthy equipment, then, and not a perennial embarrassment. For the reader, it can be said that a "slum" may be fair amusement enough on occasion, but mainly because it brings a greater appreciation of the subsequent pure air undefiled. RICHARD KOCH.

Newark, N. J.

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Conductivity Control of Heat Insulating Materials

To the Editor of Chem. & Met.:

Sir:—My attention has been called to Mr. Stiles' article "Determining Thermal Conductivity of Heat Insulating Materials" appearing in *Chem. & Met.* for October. It is a matter of immediate interest to our company, hence I feel permitted to recommend Mr. Stiles' work and instrument as a distinct contribution to the manufacture of insulating material.

A possible impression that I should like to qualify, however, is suggested after his mention of specific trade names, among which ours appears. Mr. Stiles proceeds to comment that "The majority of these plants are operating with no plant control of the insulating qualities of their boards," that they rely on laboratories for occasional tests to be used in publicity. In view of the danger of inference, with no enlightening statement to the contrary, I should like to state definitely that the Celotex Company exerts close control over the conductivity of its product as a part of the normal manufacturing process; not only that, but in many cases it also furnishes large quantities of its product with a guaranteed conductivity,—which is possible only because of the plant control. T. B. MUNROE,

Vice-President,
The Celotex Company,
Chicago, Ill.

* * * *

To the Editor of Chem. & Met.:

Sir:—In my article on "Heat Insulating Materials," Mr. Munroe of the Celotex Company feels that an injustice is likely, which was naturally contrary to my intention. The two parts of my article involved may be misleading, but since they were not intended for correlation or connection of any sort, I very much regret that any possibility of a misconstruction may exist. In order to still any possible further ambiguity, I wish to state very positively that I do not charge any single company manufacturing wallboard with a lack of proper plant control of its output. HAROLD STILES.

Iowa State College,
Ames, Iowa.

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Why the Effort?

PLANT TO MAKE FUTYL ALCOHOL—The Petroleum Chemical Corporation is making plans to erect a commercial plant for the further production of futyl alcohol. The making of this grade of alcohol . . . is of vital importance . . . It is understood the futyl alcohol is made from crude oil.—*Tulsa Daily World.*

CHEMICAL ENGINEER'S BOOKSHELF

Production Based on Economics

INDUSTRIAL ECONOMICS. By *Dexter S. Kimball.* McGraw-Hill Book Company, Inc., New York, 1929. 312 pages. Price, $3.

Reviewed by CHAPLIN TYLER

"INDUSTRIAL ECONOMICS" embodies lecture material given by Professor Kimball to third-year classes in engineering at Cornell University.

The first four chapters comprise a discussion of industrial history, the high lights of which are handicraft production, the industrial revolution, and the effect of mechanical inventions. In the ten remaining chapters the following major topics are discussed: The "Scientific Method"; Division of Labor, or Specialization; Elements of Cost Accounting; Production Economics; Standardization; Effect of Growth on Economics of Production; Elements of Organization; Management Principles; and the Mechanization of Industry.

To the reviewer the chapters of greatest interest were Chapter VIII, entitled "Relations Between Production Factors," and Chapter X, entitled "The Growth of Industrial Enterprises." Professor Kimball injects real interest into such subjects as the principle of diminishing returns; consolidation and integration of industrial enterprises; the relation of size to output and to efficiency of operation; and the limitations of consolidations. These chapters are particularly timely in view of present interest in consolidations.

Several minor errors were noted, such as the following: spelling of "writings," page 247; substitution of "personal" for "personnel," page 279; the statement on pages 294 and 295 that the chemical industry comprises 38,075 employees and an annual output of $6,438,027 (value of output obviously is disproportionate); and the spelling of "degradation," page 296.

* * * *

Handbook of Analysis

APPLIED INORGANIC ANALYSIS, with Especial Reference to the Analysis of Metals, Minerals and Rocks. By *W. F. Hillebrand* and *G. E. F. Lundell.* John Wiley & Sons, New York, 1929. 929 pages. Price, $8.50.

Reviewed by GEORGE MCPHAIL SMITH

THIS outstanding treatise is divided into five parts, as follows: I.—General Considerations, 160 pages.—Discussions of Analytical Results, The Balance and Weights, Apparatus and Reagents, Common and Special Analytical Operations, Volumetric Methods, etc. II.—The Determination of the Elements, 484 pages, including a chapter on the Platinum metals and Gold by Dr. E. Wickers. III and IV.—Silicate and Carbonate Rock Analysis, 174 pages and 32 pages, respectively; these parts consist of material taken largely from Dr. Hillebrand's well-known work on these subjects as published in Bulletin 700 of the U. S. Geological Survey. V.—Miscellaneous Methods of Analysis, 21 pages.—Soda Lime Glass and Bauxite or Refractories of high Alumina Content.

For the most part, the procedures given are based on data obtained by the senior author in the course of analyses of thousands of rocks and minerals, and by the junior author in researches and analyses dealing with miscellaneous inorganic materials, and particularly in directing the analyses of the U. S. Bureau of Standards' standard analyzed samples of ores, ceramic products, ferrous and non-ferrous materials such as irons, steels, alloy steels, ferro-alloys, brasses, bronzes, bearing metals, light aluminum alloys and pure chemicals, and in formulating standard methods, for the analysis of such materials in cooperation with committees of the American Society for Testing Materials and the American Ceramic Society. Also, since the subject is so vast that no chemist can have had the opportunity of critically testing all the methods, it was found necessary to draw on the work of others wherever the authors' experience had been meager, and this has been done with proper citations as to the source of such methods.

The writing of the book was started by the authors in 1923, and the work was well under way before the death of Dr. Hillebrand in 1925. The completed work is superlative in execution, thoroughly up to date, and maintains throughout the high standards originally set by Dr. Hillebrand in his well-known earlier bulletins. It can be unreservedly recommended as being almost a necessity in connection with exact work in the field of inorganic chemical analysis.

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Pursuing the Chemical Term

A CHEMICAL DICTIONARY. By *Ingo W. D. Hackh.* P. Blakiston's Son & Company, Philadelphia, 1929. 790 pages. Price, $10.

Reviewed by RICHARD KOCH

NEW dictionaries tend to raise the preliminary question, why another one has become necessary and what aim it has set for itself. In this case one must simply grant the necessity from experience and take refuge, for its scope, in an unadorned "chemical." Because there appears to be no modern American wordbook of chemistry that doesn't specialize in some particular interest, and this one has attacked a field that is really broadly chemical. Its worthiness of intent, then, will enable us better to inquire into its performance.

As a general precept (and incidentally a necessity) the author has committed himself to the barest brevity throughout. His definitions include only a descriptive sentence or so, and as much of formula as will illustrate it. The biographic items also serve for the merest identification. But right here it is well to add that this laconic style is the prime virtue of the book. For it enables Mr. Hackh to expand where there is a real call for clarification, while in the other instances he is aware that beyond identification a dictionary can do very little without becoming encyclopedic. Coverage is his aim, rather than exhaustiveness; and his only departure from it is the inclusion of numerous biographic portraits, justified by their appearance, and miscellaneous cuts—which, as in the case of Funnel and Bunsen Burner, appear not always strictly essential. The publishers, to conclude, have given an admirable work an altogether worthy mechanical recognition.

Colloids and Mechanical Dispersion

MECHANOCHEMISTRY AND THE COLLOID MILL, Including the Practical Applications of Fine Dispersion. By *Pierce M. Travis.* The Chemical Catalog Company, New York. 191 pages. Price, $4.

Reviewed by PAUL D. V. MANNING

ALTHOUGH the first work in colloids was begun by Graham in 1861, it has been customary ever since to speak of work in this field as a "new science" and to call it the "chemistry of tomorrow." It is perhaps for this reason, coupled with a sense of uncertainty and mystification, that the chemical engineer has not seemed very sympathetic to new developments in the field of colloids.

The author rightly points out that the subject covers all chemistry, is not a new type of chemistry, but is a state of matter, and that the chemistry of today is in reality a study of chemistry from the colloidal standpoint. "The new science of mechanical dispersion, involving the principles of physical chemistry, I am calling 'mechanochemistry,' because it involves dispersion or deflocculation by mechanical means rather than by chemical"—a particularly apt statement which should open new vistas of opportunity for the chemical engineer in the application of fine dispersion to his work.

To those of the chemical engineering profession who desire a concise book that will remove much of the mystery of the subject and will also definitely point the way to opportunities of application, this book is a necessity. To others who are more interested in theory, the reviewer recommends it because it enables the theoretician to get the viewpoint of the engineer.

The "colloid mill," although certainly not at present in a final or even very satisfactory state of development, presages a new line of apparatus and tools for the chemical industry. The author states that "there seems very little doubt . . . that within a few years' time the colloid mill will be a necessary piece of equipment for a great number of industries, and it is hoped that those who work with such machines in the future will acquire sufficient theoretical knowledge to conduct their investigation along correct lines." The book does not supply all this necessary theoretical information, but it does give some and goes further in that it acquaints the practical man with his need of enough of this knowledge to keep ahead in his own industry.

The first six chapters are devoted to "boiling down" theoretical definitions to easily-understood statements. A few errors, mainly typographical, have been noted. The seventh chapter discusses the importance of the hydrogen-ion concentration and its measurement. The usual complicated methods of measurement have been discarded in favor of a simple pocket apparatus readily adaptable to most industrial purposes and so easily operated that plant workers can use it. The reviewer has found this instrument very convenient, economical, and accurate enough for most industrial work—altogether the most desirable in use at the present time.

Of interest to industry are the discussions on gelatin and ice cream, dusts, fire-fighting foam, flotation processes, pigments, inks and de-inking, spray drying, and rubber compounding. Most of these discussions are all too brief, but the salient points are brought out, accomplishing what too few books do, and new trends of thought are disclosed to the reader.

The book is not perfect, but it is admirable and worth the price to chemical engineers.

Electrochemical Principles

PRINCIPLES AND APPLICATIONS OF ELECTROCHEMISTRY. Vol. I—Principles, 2nd Edition. By *H. J. Creighton.* John Wiley & Sons, 1928. 488 pages. Price, $4.

Reviewed by C. L. MANTELL

IN this second edition Professor Creighton has added chapters on the "activity" concept and the Debye and Hückel theory of strong electrolytes, as well as a tabulation of standardized symbols used in the book.

In general the volume follows the classic lines of treatment of the subject, but these have been brought up to date from the theoretical side. About one-fifth of the book, particularly the latter sections, covers fields commonly considered to be theoretical or physical chemistry. It is questionable whether these topics warrant the space given, which might have been more profitably employed for a wider discussion of distinctly electrochemical or electrometallurgical subjects. From a very broad view of the field, of course, this distribution of treatment can be readily justified.

That the book has found wide acceptance is shown by the appearance of the second edition four years after the publication date. Although a treatise on electrochemical principles and theories, the treatment seldom becomes abstruse or intensely mathematical, but is carried forward in a logical, progressive and interesting manner.

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Engineering English Again

ENGLISH AND SCIENCE. By *Philip B. McDonald.* D. Van Nostrand Company, New York, 1929. 192 pages. Price, $2.

Reviewed by JAMES H. COLLINS

THIS BOOK has two objectives. Professor McDonald is associate professor of English at the College of Engineering, New York University, and out of his teaching experience, evidently, he has written about the A-B-C rules of English. He deals with correct language, sentence structure, conciseness, ornateness, vocabulary, and so on. His second purpose is to enlist men of science in the cause of good writing, for the good of science and the public. To the engineer who has gone out into the world, that will be the most interesting part of his book.

Rules for writing good English are chiefly "Don'ts." It is easy to trip anybody who undertakes to tell how English should be written. Professor McDonald quotes a jolly good British report on a bad labor situation as a model. One of the opening paragraphs begins "In view of the fact that the X Company . . ." But "As the X Company" would have said the same thing. And there you are! It is a fine report despite its formality, and Professor McDonald chose well in putting it among his examples.

The vital point in good writing often eludes the scientific man: that it is done, not by rule, but by inspiration. Meaning, that the man must be full of his subject, feel it as Lincoln felt at Gettysburg, really want to tell about it, to an audience that needs to know. "The style is the man," and the man the style.

However, not all professional reports or letters can be written in this way, and for the every-day requirements of the engineer Professor McDonald has written a useful book with a commendable spirit which, in a way, is a proof of the same point.

To Ease the Strain

THE ART OF RAPID READING. By *Walter B. Pitkin.* McGraw-Hill Book Company, Inc., New York City, 1929. 229 pages. Price, $2.50.

Reviewed by MARJORIE DAVEY

THE PRESENT AGE is one of competition, not only in the business world but between those agencies which seek to inform the individual or to call to his attention the things he should know or do. Then the radio, motion pictures and the outdoors also compete for one's leisure, and in the industrial world the technical man is hard put to find time for the reading necessary to keep himself informed about happenings even in his own line of work. One solution of the problem is the more efficient use of the available time, and this was Professor Pitkin's object in preparing this book.

Reading speed varies greatly among readers and is greatly influenced by the type of material being read. In fiction, every word is scanned and savored and in heavy material of a statistical nature the same must hold true, with the possible exception of the savoring. But where reports, news stories on current events or technical articles on advances in a certain industry are concerned, the reading of every word may require an unnecessarily large share of a busy man's time. Consequently, he must of necessity be able to grasp more than just a word or a line at one time. The ideal would be for the eye to grasp the whole content of a page at a glance. Manifestly, that would be an impossible task for most of us, but by careful training the eye-grasp of the average reader may be greatly improved.

But knowing that there is room for improvement, the next question is—How? Professor Pitkin answers this query by including a large number of exercises in his book, as well as suggested schedules for outside reading. So long as a reader is engaged in extracting facts from the material before his eyes, some means of rejecting that which is not essential should be afforded him to prevent an undue waste of his time. Following Professor Pitkin's instructions he should be able to accomplish this very desirable sifting process.

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Works of Reference

HYDRO-EXTRACTORS: Their Safe Construction and Equipment. International Labor Office, Geneva, Switzerland, 1929. (Distributed in U. S. by the World Peace Foundation, 40 Mt. Vernon St., Boston.) 102 pages. Price, $1.

AN autonomous division of the League of Nations, the International Labor Office is publishing a series of monographs, of which this is the second, on individual problems in accident prevention.

After classifying the various types of hydro-extractors the authors describe the source of danger in some detail, following this with a discussion of centrifugal design from the standpoint of mathematics and construction. The remainder of the book is given over to some general considerations in connection with safe practice and descriptions of a number of cases. The treatment is such that the volume should be valuable not only to manufacturers and purchasers of new equipment but especially to those who contemplate buying used centrifuges.

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GMELINS HANDBOOK DER ANORGANISCHEN CHEMIE: Iron. 8th Edition. Verlag Chemie, G.m.b. H., Berlin, 1929. 224 pages. Price 33 M.—In this first new section on "Iron" are covered the geographic occurrence of the ores (by countries), the iron minerals, and the production of the pure metal.

COMMERCIAL AND INDUSTRIAL ORGANIZATIONS OF THE UNITED STATES. 1929 Edition. Bureau of Foreign and Domestic Commerce, Washington. 272 pages. Price, 60 cents.—More than 13,000 organizations are listed in the new edition, grouped according to their national scope; the former group is classified by name and industry, with secretaries' names included as an innovation over the previous edition (1926).

TASCHENBUCH FÜR BERG UND HÜTTENLEUTE, 2d Edition. By *F. Kögler.* Wilhelm Ernst & Sohn, Berlin, 1929. 1207 pages. Price, 33.5 M.—Designed as a reference work for practicing engineers in mining and metallurgy. Its purpose is to orient the engineer quickly when he enters upon a new division of the field, and to give him the fundamental principles and approximate figures for his sketches and decisions. Each of the thirty-five divisions treated by the book has been written by an experienced specialist in that field, and especial pains are taken to give performances and costs for each operation of some value to American readers for making comparisons.

AMERICAN FERTILIZER HAND BOOK, 1929. 22d annual edition. Ware Bros. Company, Philadelphia, 1929. Price, $15.—Its increased size is an indication of the growing scope of the fertilizer industry; the normal features, on which the trade has relied for so many years, are again present in all detail.

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Society Reports

SOCIETY OF CHEMICAL INDUSTRY: Annual Reports on the Progress of Applied Chemistry. Vol. XII. 1928. Published by the Society London, 1929. 741 pages. Price: 12s. 6d., non-members; 7s. 6d., members.—Authorities have contributed to the numerous individual sections, which are intended to cover chemical industrial developments during 1928. Due to the brevity of the single treatments the volume as a whole gains in scope.

AMERICAN GAS ASSOCIATION PROCEEDINGS, 1928. Published by American Gas Association, Inc., New York. 1600 pages. Price $3.—Report of the annual convention of the association, containing a large number of important technical committee reports and original papers, which afford the meat of the last annual gathering.

TECHNICAL ASSOCIATION PAPERS, SERIES XII, No. 1. Published by the Technical Association of the Pulp and Paper Industry, New York, 1929. 294 pages. Price, $3.—Papers and addresses presented before the association at its sessions earlier this year, as well as a directory of members.

AMERICAN ELECTROCHEMICAL SOCIETY, TRANSACTIONS, VOL. LV, 1929. Published at the office of the secretary, New York, 1929. 406 pages. Price, $2.50—Proceedings and papers of the general meeting at Toronto in May.

NATIONAL FERTILIZER ASSOCIATION, PROCEEDINGS OF 5TH ANNUAL CONVENTION. Published by the Association, Washington, D. C., 1929. 173 pages—Proceedings of convention at New London, Conn., in June, containing reports and papers.

A.S.T.M. TENTATIVE STANDARDS, 1929. American Society for Testing Materials, Philadelphia, 1929. 901 pages. Price, $7 in paper, $8 in cloth.—Of 173 standards, 34 relate to metals, 20 to cement and earth products, 72 to petroleum, paving and coating products; 25 to rubber, insulation and textiles, and 22 to miscellaneous materials including containers and coal products.

Experience Dictates Construction Materials For Handling Corrosive Agents

By A. H. Coopfr

Knoxville, Tenn.

IN SELECTING a material of construction for chemical equipment the controlling factor is usually the corrosive agent to be handled, the specific material and its cost taking second place. The primary purpose of the following discussion is to bring together, in a condensed form, widely scattered information on the important corrosive agents and the materials used industrially to resist them, pointing out the direction of developments in this field. Materials to resist corrosion cover a very broad subject, and one with which it is difficult to deal concisely, due in part to the large and increasing number of useful alloys, but more to the diversity in service requirements.

It is a well known fact that many factors influence the corrosion resistance of materials and their adaptability for specific service. In selecting a material for corrosion resistance the following points must be considered: Type of apparatus; temperature ranges; concentration changes in corroding liquid, caused both by actual changes during the process and by exposure of the atmosphere after draining; velocity of liquid movement or rate of stirring; impurities occurring in the corrosive agent; cycle of operations including time of exposure per day. A metal which owes its stability largely to the formation of a protective coating may be good for a container, but would show more rapid deterioration in moving liquids in which the protective coating is continually removed. Small amounts of impurities will often produce great changes in the corrosion rate.

Proper material selection should be based upon an economic balance which considers initial cost, imminence of obsolescence, cost and availability of materials for replacement, cost of shutdowns, and freedom of the product from contamination. The following summary gives the materials of construction commonly used for various conditions. It does not attempt to give the entire range over which the material will resist corrosion but indicates the range over which it generally finds application.

Realizing that the vast literature of corrosion contains much that can profitably be condensed and gathered together in one place, Chem. & Met. engaged Mr. Cooper to make the accompanying literature survey. Although space prohibits exhaustive coverage, the survey will be found to represent a true cross-section of practice in handling sulphuric, nitric, hydrochloric and acetic acids, alkalis, ammonia and hydrogen sulphide.

Sulphuric Acid

SULPHURIC ACID is without doubt the acid most widely used in the chemical industry. Not only in its manufacture but in its various uses practically all concentrations must be handled, and consequently construction materials cover a wide range. In the behavior of concentrated sulphuric acid, particularly at high temperatures, oxidation plays a prominent part but it is little ionized and its salt-forming ability is less marked. Dilute sulphuric acid, on the other hand, acts towards metals in most cases as an acid, and causes little or no oxidation.

There are both ferrous and nonferrous alloys which successfully resist its action. Concentrated sulphuric acid acts only slightly on cast iron, and a close grained iron may be used for handling acid of 90 per cent to fuming strength. Action increases with concentration. In order best to resist the acid cast iron should have a high total (and a low graphitic) carbon content, being the reverse conditions for successfully handling alkalis.

Below 90 per cent, cast iron is useless for sulphuric acid and it is here that high-silicon irons meet the case. As far as resistance to corrosion is concerned, high-silicon irons are very resistant to all concentrations and temperatures. These alloys have been of extreme importance in the field of corrosion under oxidizing conditions. The limitations, however, in regard to fabrication and physical characteristics make these materials unavailable for some applications.

Lead is the traditional material of construction for sulphuric acid equipment, resisting the action of acid up to 75 per cent. It cannot be used very satisfactorily for higher concentrations or at elevated temperatures. Hard lead has increased mechanical strength, but very pure lead is more resistant to corrosion than the alloyed product, its physical properties being necessarily impaired to gain this advantage.

For resistance to hot or cold sulphuric acid up to 75 per cent, aluminum bronze is useful where a combination of strength and resistance to wear are essential. Monel metal offers good resistance and is used extensively with dilute acid for pickling and for dye manufacturing. Copper-silicon-manganese resists cold sulphuric in all concentrations at room temperatures, and hot acid up to 50 per cent. Nickel-silicon, nickel - silicon - copper - aluminum and nickel-molybdenum-iron alloys resist the acid very well. Hard rubber linings are stable towards sulphuric acid under 150 deg. F., up to 60 per cent. Tantalum offers excellent resistance in all concentrations and temperatures except to boiling, concentrated acid. High nickel and nickel-chromium-silicon steels offer good resistance to most strengths. Wood can be used for dilute acid, especially if treated with an acid-resisting paint or paraffin. With a paraffin or asphalt coating fairly concentrated acid may be handled in wood equipment.

Acid-proof brick or lead lining can be used for absorption towers; cast iron or steel can be used for absorbers for concentrated acid; acid-proof brick, coke, quartz or stoneware is used for absorption tower packing; fused silica, or high-silicon iron is used for concentrators; pumps give satisfactory service for low concentrations when made of aluminum bronze. High-silicon iron, hard rubber linings or Monel metal are used for dilute acid at low temperatures. Steel or cast iron can be used for concentrated acid. Pickling tanks can be made of aluminum bronze, lead, Monel metal, stoneware, acid brick or wood. Hard rubber and wood are used for storing low concentrations of acid, and steel for high concentrations. Sulphuric acid stronger than 60 deg. Bé. may be shipped satisfactorily in iron or steel containers. Hard rubber pipes may be used to convey the dilute acid but high-silicon iron is used for most of the higher concentrations.

Hydrochloric Acid

ON ACCOUNT of the great reactivity of hydrochloric acid toward the metals, it is one of the most difficult of all materials to handle in industrial operations, especially if used

hot. During the last few years there have been numerous alloys successfully developed for handling the various corrosive solutions, but there have been none developed, commercially practicable, that will completely withstand the action of hydrochloric acid under the varying conditions experienced in industrial plants. It attacks practically all of the metals and alloys and, in general, for rigorous requirements the acid must be handled in non-metallic materials.

IN HANDLING HCl the following materials are used successfully: Certain alloys, stoneware, glass, hard or soft rubber, enameled steel and fused silica. Rubber, it should be noted, is not ordinarily considered for temperatures above 150-200 deg. F. although one case is on record (*Chem. & Met.* **36**, 1929, 355) where boiling HCl is successfully handled with rubber.

Chemical stoneware is resistant to all concentrations and temperatures of the acid, but has the objection of high initial cost, poor heat transfer and low mechanical strength. Wood can be used for low concentrations at ordinary temperatures. High silicon irons, phosphor bronze, manganese bronze, aluminum bronze and Monel metal can be used for handling dilute acid. The fact remains, however, that they slowly corrode, necessitating replacement, and introducing impurities in the acid which may have a harmful influence on the product.

Nickel - molybdenum - iron alloy (60-20-20) is particularly resistant to concentrated hydrochloric acid at room temperature, showing 10 to 18 times the resistance of most corrosion resistant alloys. It is also highly resistant toward hot acid, the stronger acid being less corrosive. Nickel-silicon-copper-aluminum alloys do not resist the acid as well as the nickel-molybdenum-iron alloys but are still considerably better than most of the commercial alloys, being more resistant to the weaker acid. Cobalt-chromium-tungsten alloys and tantalum are extremely resistant to HCl, but because of their cost, must be considered from an economic standpoint. Enameled equipment has been in many cases the only resource in handling HCl economically.

Rubber resists the acid extremely well and gives no trouble in storage and transportation equipment. Chemically, hard rubber is one of the most inert materials available for commercial application in handling HCl, the temperature being the only limiting factor. Rubber coatings are remarkably versatile in their uses. Soft rubber slowly ages, while hard rubber does not, but has the disadvantage of brittleness. With respect to cost, hard rubber linings are in general somewhat cheaper than soft rubber; however, both are moderate.

For the storage of hydrochloric acid, glass carboys, stoneware, enameled, rubber- or glass-lined steel tanks and rubber-lined wood tanks, are most used. Carboys are difficult to handle and empty. The chief difficulty with stoneware is its weight. Glass lined or enameled equipment has the advantage of light construction and is practically indestructible from acid corrosion, regardless of temperature.

Wooden tanks may be used satisfactorily for storing or processing of the acid up to 20 per cent and 212 deg. F. Quarter sawed cypress is generally considered the best material for this use. For higher concentrations it is necessary to treat the tank with pitch, asphalt or paraffin.

Acid pumps are usually made of stoneware or hard-rubber-lined steel. For transferring HCl to various parts of the plant, glass, stoneware, tile, hard rubber, rubber lined steel pipes and rubber hose are used; however, under plant conditions where there is more or less vibration there is likely to be difficulty in obtaining tight joints in using the first three materials. Steel pipe lined with hard or soft rubber give very satisfactory service under these plant conditions.

Steel barrels and tank cars have been lined with vulcanized rubber and used for years without any evidence of deterioration of the rubber or loosening of the lining from the steel. The development of various bonding processes has eliminated separation of the rubber from the steel and allowing much greater use of rubber-lined equipment.

Agitators, centrifugal baskets, wash trays, and filter presses have given excellent service where made of hard-rubber-covered steel.

Monel metal is used extensively in equipment for handling the dilute acid used in pickling and dye manufacture.

Successful dryers have been made of wood or brick, heated with steam. The steam coils are not attacked as long as they are hot so that the HCl vapors cannot condense on them. The most satisfactory trays for these dryers were found to be a graphite composition of the type from which graphite crucibles are made.

Hydrochloric acid fumes readily and since the fumes are so corrosive, provision must be made for their removal. Cypress coated with pitch, asphalt or paraffin, high-silicon iron and tile have all proved satisfactory for fume ducts. Wood, however, is generally most satisfactory.

Nitric Acid

BESIDES being a strong acid, HNO_3 is a vigorous oxidizing agent even in very dilute solutions. Commercial nitric acid, dilute or concentrated, attacks almost all except the noble metals, but these are too costly for general use in the chemical industry. Aluminum is usually satisfactory for cold, dilute or concentrated nitric acid, but does not resist the acid well in concentrations between 20 and 40 per cent. The pure metal resists the acid and its fumes very well in the ranges indicated, but when so used the temperature should not be allowed to rise appreciably; except that very weak acid may be used at higher temperatures in some cases. When handling nitric acid in aluminum equipment it is important that there be no sulphuric or hydrochloric acid present as even small traces will cause corrosion.

Iron-silicon alloys, containing 14 per cent or more of silicon, are excellent for corrosion resistance and are of extreme importance in handling nitric acid in all concentrations and temperatures. They are very brittle and are only available in cast form but are practically unaffected by nitric acid. Chemical stoneware is resistant to nitric acid under all conditions but has the disadvantages of poor heat transfer and low mechanical strength.

Glass lined and enameled equipment has been used successfully to resist the corrosion of nitric acid. Although this equipment has given better service than most materials, the enameled equipment is susceptible to surface line attack.

Vulcanized hard rubber linings are fairly resistant to cold dilute nitric acid up to 20 per cent.

Chromium plating and asphaltum-base paint protect iron and steel against nitric acid and its fumes very satisfactorily.

TANTALUM is not attacked by HNO_3 of any concentration or temperature. It should be noted, however, that tantalum cannot be used in air above 350 deg. C.

Iron and steel are fairly resistant to highly concentrated acid but are rapidly corroded by the dilute acid. When immersed in 40 per cent acid or over, iron becomes passive and the rate of solution is greatly lowered; it acts in many respects like a noble metal. In general, due to the passivity produced, concentrated nitric acid when mixed with sulphuric may be handled with the ferrous metals and alloys.

Although these materials are satisfactory under some conditions, high-chromium steel alloys are now coming into use on a large scale for the handling of nitric acid. While the stainless alloys are not resistant to the crude acid produced by the older process from Chile saltpeter (because of the presence of the chlorides, bromides and iodides, all of which attack chromium) the purified acid is satisfactorily resisted, as is the acid produced from oxidation of ammonia.

An alloy of 14 per cent chromium will resist the concentrated acid, but not the dilute. In order to obtain resistance to all concentrations and temperatures a chromium content of 18 to 20 per cent is necessary, with the carbon content below 0.12 per cent. The addition of nickel to the chromium alloys prevents coarse crystalline growth at high temperatures and increases the resistance to nitric acid. For highly corrosive conditions, where the first cost of the equipment is not of prime importance, a suitable material is the 18-8 chromium-nickel steel. The stainless steels can be fabricated into any form or shape that can be made from ordinary boiler steel. One feature of

the chromium-nickel steels is their better welding qualities.

For shipment of nitric acid, aluminum drums can be used for the concentrated product. Stainless iron drums and tank cars have proved satisfactory for all concentrations, but the best material is the 18-8 chromium-nickel steel. The acid may be safely shipped in ordinary steel drums or tank cars if a small amount of sulphuric acid is added; or if 5 per cent chromium is alloyed with the steel the addition of sulphuric acid is not necessary for resistance to the concentrated acid.

Acid towers built either of acid brick or high-chromium steel have proved satisfactory for all concentrations and temperatures. Aluminum has been found satisfactory in absorption systems where very pure acid is made, 20 40 percent being the most corrosive strength.

Cast iron is used for nitric acid pots; fused silica, glass, high-silicon iron and stoneware are used successfully for condensers; glass, high-silicon iron, and stoneware are suitable for piping; pumps and fans are made from high-silicon iron and stoneware.

Acetic Acid

OF THE organic acids, acetic is by far the most important commercially, and one of the strongest. Copper and aluminum are both little acted upon by strong acetic acid, but aluminum is attacked more strongly than copper by the dilute acid. Copper is extensively used in spite of the fact it is corroded by oxidizing agents. The success with which copper can be used depends upon the flushing of the air from the stills and condensers, as otherwise corrosion results and a discolored product may be obtained. Aluminum is gradually replacing copper as a material of construction, although copper remains the most desirable material for use in distilling and handling of crude acetic acid due to the corrosive action that even small amounts of formic acid have on aluminum.

The presence of air has little effect on the corrosion of aluminum and aluminum is therefore recommended for concentration of pure acid, separation from its higher homologues, and for condensing and cooling coils. Aluminum resists pure acid, from 25 per cent up, very well. High-silicon irons are extremely resistant to the corrosive action of all concentrations and temperatures of acetic acid. Aluminum bronze (9 to 10 per cent Al; 1 to 4 per cent Fe) is resistant to the concentrated acid. Monel metal, or pure nickel gives satisfactory service. These materials combine good acid resisting properties with high strength and ease of fabrication. Chromium steel (18 per cent); chromium-nickel (18-8) steel; chromium-copper-molybdenum; and chromium-nickel-silicon iron alloys offer exceptionally good resistance to attack by all concentrations. Commercial tantalum is excellent for resistance at all concentrations and temperatures below 350 deg. C. in air. Chromium plating is highly resistant as long as the coating remains intact.

For the storage of weak acetic acid, wood, or hard-rubber-lined tanks may be used as well as glass-lined steel and stoneware. Aluminum, copper and lead lined equipment is also used. With the exception of wood, any of these materials can be used for storage of concentrated and glacial acid. Piping can be made of aluminum, copper, glass, enameled iron or steel, fused silica, hard rubber, high-silicon iron, and Monel metal. In this connection the present tendency is toward the use of aluminum or hard-rubber-lined steel pipes for the handling of all concentrations of the acid.

For pumps aluminum, aluminum bronze, hard-rubber-lined, high-chromium steel, high-silicon iron, Monel metal and stoneware can be used for concentrated acid. Aluminum and copper can be used for distilling concentrated acid; fused silica for all concentrations and cast iron for 29 per cent acid. Aluminum, copper and enameled iron can be used for condensers for concentrated or glacial acid; fused silica, high-chromium steel, high-silicon iron, tantalum, or stoneware for all concentration. Reaction vessels for all concentrations are usually made of high-chromium steel, high-silicon iron, stoneware and glass lined steel; or aluminum, nickel, copper or lead for concentrated acid.

Alkaline Corrosives

HANDLING of alkalis in the plant or in making shipments is much simpler than is the same problem in handling acids. Solutions of the alkalis do not react appreciably with most of the metals; in fact, small amounts of sodium carbonate tend to lessen the corrosive action of water on iron and steel. With the exception of ammonia, the solutions of the alkalis behave very much alike in all of the chemical reactions.

Of the commercial materials which resist caustic alkalis well enough to be used for plant equipment are: Nickel, copper, magnesium, tantalum, cadmium and chromium plating, wrought iron, mild steel, Monel metal, nickel-chromium alloys, cobalt-chromium-tungsten (50-60; 30-40; 8-20), aluminum bronze, nickel-molybdenum-iron, nickel-chromium-manganese, high-chromium and chromium-nickel steels, chromium-tungsten steels, rubber and asbestos.

On account of the resistance of iron to alkalis there has not been the same necessity for developing alkali-resisting alloys as there has been for the acid-resisting alloys. Nickel being very highly resistant, it is widely used. It is not affected by the caustic alkalis, either fused or aqueous. Monel metal and the other nickel-copper alloys resist the alkalis almost as well. Aluminum bronze and copper-silicon alloys offer good resistance, but pure copper is not often used as it is but very little better than the steel for caustic soda.

Magnesium is unaffected by alkalis of any concentration or temperature, but is readily attached by acids or saline solutions even when very dilute and at room temperatures. Tantalum is excellent for caustic alkalis in most strengths, but is slowly attacked by hot concentrates. At ordinary temperatures lead satisfactorily resists alkali solutions of concentrations up to 25 or 30 per cent.

Both for apparatus handling alkalis and for structural parts exposed to their action iron and steel and their alloys are very useful materials. Cold dilute alkalis have very little effect upon iron or steel. Cast iron is used for handling fused caustic or concentrated solutions; however, there is some corrosion in this case, especially when air is used for agitation.

ADDITION of nickel improves the resistance. Steel, cast iron and wrought iron stand up fairly well under the action of dilute alkalis at all temperatures, the choice of material for a particular case depending upon the physical characteristics desired. Caustic solutions are commonly stored in tanks, handled with pumps through pipes, and shipped in drums, all made of steel or wrought iron (or cast iron for pumps). The iron-silicon alloys, which have such wide application in the handling of acid solutions are, in general, not suited for use with caustic alkali, except in dilute solution, as the alkali dissolves the silicon and leaves a porous mass. Cadmium and chromium plate resist the caustic alkalis and alkali carbonates satisfactorily in all concentrations and at all temperatures.

Vulcanized hard rubber linings offer excellent resistance against alkalis, remaining a tough, pliable substance for many years without any indication of deterioration, provided the temperature is not over 150 deg. F. The first cost may seem relatively high but it is soon compensated by the prolonged service life of the treated equipment.

Cast iron and low-carbon steel stand up well for caustic fusion pots. For severe service the outside if coated with nickel gives excellent resistance against oxidation at high temperature. The coefficients of thermal expansion of the two metals are nearly the same and there is no tendency to draw apart when heated to high temperatures. This combination furnishes qualities which have not been obtained by other materials. Monel metal gives good service and is used in the dye industry for fusion pots, for example.

Strong caustic and soda ash solutions cause rapid deterioration of filter cloths, particularly when the latter are subjected to high temperatures for prolonged periods. It is sometimes economical in the end to use metallic filter cloths of Monel metal if the precipitate is not of semi-collodial nature. If the liquors contain sulphides, however, Monel metal cloth is too susceptible for satisfactory use.

Tantalum, offering such good resistance, is found to be economical, and is gaining favor for spinnerettes in the rayon industry where it is called upon to resist both acid and alkaline corrosion.

Ammonium Hydroxide

ALUMINUM and tin are unaffected by ammonia alone even in the presence of air, but the former can rarely be used since the presence of only small amounts of alkali salts will cause the formation of alkali hydroxide and rapidly attack the metal.

Where ammonia is evolved as a by-product, it is usually handled in lead lines if the vapors are moist, as lead is practically the only metallic material available for handling moist ammonia satisfactorily. Although iron lines may be used for dry ammonia gas, liquid ammonia, and moist ammonia vapors if, in the latter case, contamination by iron rust is not objectionable.

For ammonia synthesis, at 500 deg. and 1,500 atmospheres pressure, wrought iron, mild steel, copper and nickel all fail rapidly. A suitable material would contain at least 2.25 per cent chromium and not more than 0.3 per cent carbon, the resistance being improved with higher chromium content. High-chromium and chromium-nickel steels of the stainless type are most resistant but are more difficult to fabricate.

Mild steel, high-chromium steel and chromium - nickel steels, tantalum, nickel, nickel-chromium alloys, Monel metal and aluminum bronzes are extremely resistant to all concentrations of ammonium hydroxide. Chromium plating has proved to offer satisfactory resistance to all concentrations of alkalis. Vulcanized hard rubber gives excellent resistance against ammonium hydroxide in all concentrations, if the temperature is below 125 deg. F. Copper should never be used where it will be exposed to ammonia.

There are relatively few places where ammonium hydroxide is used as one of the principal components of a reaction. One of the more common cases where ammonia is used is in the manufacture of ammonium nitrate from ammonia liquors and recovered nitric acid. In the storage of ammonia liquors the moist vapors have been found to be more corrosive than the liquors, and particular attention should be exercised that there are as few connections as possible above the liquid level. During neutralization brick-lined wooden tanks, placed underground, are probably the best.

In cases where the nitro-group acts as an oxidizing agent, as in the manufacture of nitro-amino compounds, corrosion takes place in spite of the exclusion of the air and enameled equipment must be used if the product is to be very pure.

For pumps and valve parts, Monel metal is used satisfactorily for handling anhydrous ammonia. Steel can be used for anhydrous or aqueous ammonia in all concentrations. In handling ammonia vapor aluminum and lead give good service.

Hydrogen Sulphide

CHROME-NICKEL alloys, aluminum bronze, aluminum, duraluminum and aluminum paint are resistant to hydrogen sulphide, showing no signs of attack. Nickel-molybdenum-iron alloys also resist H_2S fairly well. The corrosion of pressure stills in the petroleum industry is one of the principal sources of expense and danger, caused by hydrogen sulphide. The parts of cracking stills operating at high temperatures and pressures are subject to corrosion and to mechanical strain unusual in other equipment. Calorized iron, aluminum, stainless steels and nickel-chromium steels offer excellent resistance under these extreme conditions. In the use of plugs to seal up cracking systems, Monel metal, while it slowly corrodes, has other advantages, and by proper design these plugs give two to three years service. The use of electroplating with corrosion resisting metals, such as chromium, has proven satisfactory. A recently developed ceramic lining (*Chem. & Met.*, Oct. 1929, p. 596) is giving good results. It requires attentive care in application but has solved an annoying problem in a very gratifying way. At present it seems best for rather plane surfaces.

As a result of the high temperature in the pressure stills, hydrogen sulphide is produced from decomposition of the sulphur compounds. Caustic soda, soda ash, or lime added to prevent the liberation of hydrogen sulphide have been found to cut the corrosion to less than half; however, this does not entirely solve the problem and the solid material resulting from this treatment is likely to cause overheating.

It has been found that roof plates of tanks storing sulphur-containing oil corrode much more rapidly than the sides of the tank below the oil level. "Sour" crude oil has the reputation of eating out these steel roofs in a short time, the sulphur gases arising from the oil and combining with the condensed moisture from the atmosphere.

By pumping in oil until the air is all forced from the tank, the oil being in contact with the roof, corrosion is greatly retarded. By use of a floating roof which moves up and down as the oil level changes, the corrosion of the roof is found to be no greater than on the sides of the tank.

The experience of others have been largely drawn upon in the search for material for this paper and although no individual references appear in the text, acknowledgment is here made to the individual references appear in the text, ing bibliography.

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Selections from Recent Literature

SOLVENT RECOVERY. S. Reiner. *Kunststoffe,* October, pp. 219-22; November, pp. 250-2. Many industrial processes use solvents in such a way that recovery of the vapors is essential, either for economy or safety reasons, or both. Of five principal processes, only three are actually successful and economical in practice. These are the adsorption (active carbon), condensation-adsorption, and absorption-condensation methods. The first has the great advantage of adaptability to continuous operation; combining adsorption with condensation has the advantage of increased yield. In the adsorption method, the active carbon must be carefully chosen for the specific purpose; the best decolorizing carbon does not necessarily perform best in solvent recovery. A flow sheet is shown of a plant for continuous adsorption recovery of ether-alcohol vapors from air, utilizing the Bayer process, which is applicable even to such highly volatile solvents as methyl chloride. Silica gel also has been effectively used in adsorption recovery plants. A special case in solvent recovery is that method of making dipped rubber goods in which the articles are dipped in rubber-benzene cements of decreasing concentrations and washed in alcohol between dips. A separation method for the alcohol and benzene is described. Other processes in which solvent recovery is necessary include the manufacture of artificial leather, celluloid, smokeless powder, and various cellulose ester and rubber goods; and degreasing and fat extraction processes.

CONCRETE CONSTRUCTION. Richard Grün. *Zeitschrift für angewandte Chemie,* Nov. 16, pp. 1070-4. The chemical resistance of concrete depends on its physical structure as well as its composition and conditions of exposure. Rammed concrete has the highest mechanical strength, but is more porous and hence less resistant than plastic concrete. The latter therefore is preferable for all chemical plant construction except where the greatest strength is essential. The basic nature of concrete makes it nearly immune to attack by alkalis, except very strong caustic, but highly susceptible to acid attack. Even sugar, not ordinarily considered an acid, has caused damage in some instances by forming calcium sucrate with the lime in concrete. In the industrial uses of concrete the most common attacking acids are sulphuric, sulphurous, carbonic, acetic and lactic. Hydrogen sulphide is not in itself actively harmful, but oxidizes readily to sulphurous acid. Salts handled in chemical plants, or occurring in sea water, ground waters, soil, and the like are often harmful, with salts of ammonia and magnesium among the principal offenders. To make concrete resistant to chemical attack the first considerations are to choose a suitable binder and to make the concrete as dense and non-porous as possible. Slag cements, having a lower lime content, are better binders than straight portland cement for chemically resistant concrete. Other important means of preventing attack are the use of protective coatings (generally bituminous), and designing structures to minimize direct contact of the concrete with corrosive liquids or gases. As an example of the latter, comparative drawings are shown of a flue for gases containing chlorine and nitrogen oxides.

CORROSION IN DYEING PLANT. A. A. Pollitt. *Dyer & Calico Printer,* Nov. 15 (Jubilee Number), pp. 577-81. The search for materials which will resist the corrosive conditions encountered in modern dyeing practice has led away from former methods of selecting equipment; price has given way to performance as the basis of choice. It is true in dyeing, much more than in most corrosion problems, that the effect on the material being processed is likely to overshadow equipment loss as an item of corrosion damage. Among the metals, stainless steels, nickel and Monel metal are most generally useful for apparatus which will not alter the tint or uniformity of dyeings and which resists attack by dye baths. Stoneware has some uses but carries a considerable breakage hazard. Enameled and glass-lined apparatus resists corrosion effectively, but in dyeing plants the risk of chipping and exposing the metal greatly restricts the applicability of such equipment. Wood, formerly much used, is too absorptive. It also causes staining and alterations in shade if used for dye vats. Bakelite, compounded with asbestos to overcome the shrinkage difficulty, gives a material (Haveg) which has excellent corrosion-resisting properties, especially against hot or cold hydrochloric acid. It also resists the numerous salts and bleaching liquors used in textile processing. A modified composition, without asbestos, has been developed which even resists hydrofluoric acid. Haveg is attacked, however, by caustic alkali and by the strong oxidizing acids.

WASHING RAPID FILTERS. Roberts Hulbert and Frank W. Herring. *Journal of the American Waterworks Association,* November, pp. 1445-87; discussion, 1487-1513. Difficulties with shrinkage and cracking in large sand filter beds for water purification have now been shown to be mainly a matter of sand grain size and washing practice. There has been much controversy on this problem, with considerable confusion of cause and effect. Experience in the Water Supply Department of Detroit has led to a successful system of washing, of a properly selected sand, which keeps the filter bed clean and free from cracks and mud-ball formation. The wash rate in this system is high enough to expand the sand much more than is done in standard practice. The effective grain size of the sand was 0.55 mm., and its uniformity coefficient was 1.35, in the two-year experimental program in which the system was developed. It was found that the amount of expansion of the sand bed varies with the thickness of the bed, but not with the amount of free-board or lift above the sand. It depends also on temperature, rate of wash water flow, and grain size. An equation is given for calculating the rate of wash which will give a desired degree of expansion.

EMULSIONS. J. F. Carriere. *Chemisch Weekblad,* Aug. 10, pp. 413-6. For determining to which type (water-in-oil, oil-in-water, oil-in-glycerol, glycerol-in-oil, etc.) an emulsion belongs, one of three methods is generally used. These are the Pickering dilution, the Robertson selective staining and the Clayton electrical methods. All of them, however, are open to the objection that they reveal little or nothing of the finer structure of the emulsion. A still greater objection is that there is always a possibility of phase reversion due to the treatment (dilution, dye addition or electrical current) used for the test; that is, none of these methods is perfectly certain. A refractometric method has therefore been applied to this problem. It is a modification of Schroeder van der Kolk's method of examining fibers, starch granules, and the like, and depends on the fact that the droplets of an emulsion appear dark or light to right-hand illumination under a microscope.

FURNACES. J. S. Atkinson. *Glass,* November, pp. 463-9. In the design of gas producers for metallurgical furnaces, choice of fuel for ordinary work is chiefly limited to bituminous coal. Briquetted lignite, of not too high moisture content, is successfully used in Australia, and to a considerable extent also in Germany. Anthracite is necessary, in spite of its cost, when very clean gas is required. Coke also has some advantages, especially in providing a strongly reducing atmosphere without smoke. There are a few special cases in which use of a blended fuel is desirable. When washed coal is used, the moisture content must be carefully checked. The ash content should not be lower in most cases than 5 to 6 per cent, and it is doubtful if washing pays when the coal has less than 8 or 9 per cent ash. Some mechanical devices for fuel feed, ash discharge and fire-bed agitation are described and illustrated.

ELECTRICAL TREATMENT OF GASES. Kurt Peters. *Brennstoff-Chemie,* Nov. 15, pp. 441-4. Of the several kinds of electric discharges, the most important from the practical standpoint are the arc, the silent discharge, and the low-pressure discharge. Theoretical study of arc effects has been mainly in connection with nitrogen fixation. A less familiar application is in the production of carbon black and acetylene from hydrocarbon gases. The silent electric discharge is useful for its polymerizing

effect and for activating gases. Its industrial use is limited by low yield and low current density. Low-pressure discharge gives a useful means of effecting endothermic reactions and ionic reactions at relatively low temperatures. The Kaiser - Wilhelm - Institut für Kohlenforschung has developed a discharge tube which has operated satisfactorily over long periods, with high electrical load and large gas throughput. It has been found that not only methane but the higher hydro-carbons (naphthalene, anthracene, petroleum oils and even pitch) can be converted into acetylene by a low pressure discharge. In presence of nitrogen, prussic acid can be obtained. Removal of products as formed makes possible excellent yields in the laboratory trials. Production on a commercial scale has not yet been accomplished, but energy relations and other considerations which affect costs do not indicate any fundamental obstacles to successful application of the low-pressure discharge for a number of endothermic reactions.

PROCESS CONTROL. H. A. J. Pieters and J. A. Meylink. *Chemisch Weekblad*, Nov. 16, pp. 568-70. The gas interferometer can be adapted to various measurements useful in process control, being calibrated to the kind of gas to be observed. As a specific example, an instance is described of adaptation of the interferometer to control of the operation of benzol scrubbers in coke plants. Since the benzol in gas is a mixture and not merely benzene, it was not feasible to adjust the instrument according to one refractive index; calibration according to the benzol content was necessary, with gas such as actually occurred in practice. The calibration having been successfully accomplished, it was found to be easy to make measurements of the benzol content of coke-oven gas, either before or after scrubbing. A comparison of this method with the active carbon adsorption method showed very favorable dependability of the interferometer, with a large saving of time.

STEAM ACCUMULATORS. *Apparatebau*, Nov. 15, pp. 265-9. The advantages of increased production, improved quality of product, and fuel economy as made possible by use of steam accumulators are exemplified in some typical installations. A case in point is a sugar refinery at Malmö, Sweden, which has a horizontal Ruth accumulator of 330 cu.m. capacity, operating in the pressure range 0.8 to 2.5 atm., and yielding in this range 10,000 kilos of steam. Another example is in a milk and chocolate factory at Bissenhofen, Germany. This is a horizontal accumulator, having a capacity of 86 cu.m. and yielding 5,900 kilos of steam in the pressure range from 3 to 12 atm. One of the leading economies in the use of steam accumulators lies in the fact that the steam generating equipment need be made adequate for the average load only. The accumulator takes the place of the boiler capacity generally provided in excess of average load.

Recent Government Publications

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Some Properties of Sponge Rubber. Bureau of Standards Circular 377. 5 cents.

Weights per United States Gallon and Weights per Cubic Foot of Sugar Solutions. Bureau of Standards Circular 375. 5 cents.

Ochres and Mineral Pigments of the Pacific Northwest, by Hewitt Wilson. Bureau of Mines Bulletin 304. 15 cents.

Facts Relating to the Production and Substitution of Manufactured Gas for Natural Gas, by William W. Odell. Bureau of Mines Bulletin 301. 35 cents.

Flow of Gases Through Beds of Broken Solids, by C. C. Furnas. Bureau of Mines Bulletin 307. 30 cents.

Development of the Gypsum Industry by States, by R. M. Santmyers. Bureau of Mines Information Circular 6173. Mimeographed.

Report on Smelting in the Lead Blast Furnace. Three additional parts of the report of this study issued as Bureau of Mines mimeographed serials, as follows: Part III—Rate of Descent of Stock Column and Formation of Accretions, Serial 2963; Part IV—Composition and Temperature of the Gases at the Tuyère Zone, Serial 2965; and Part V—Effect of Conditions at Various Tuyères on the Form of Lead and Composition of the Slag, Serial 2966.

Statistics on Wages and Prices. Three bulletins of the Bureau of Labor Statistics, as follows: No. 499, History of Wages in the United States From Colonial Times to 1928, 80 cents; No. 495, Retail Prices, 1890 to 1928, 35 cents; and 491, Handbook of Labor Statistics, 1929 Edition, $1.

Supplement to Commercial and Industrial Organizations of the United States, 1929 Edition. Leaflet dated Sept. 1, issued by the Bureau of Foreign and Domestic Commerce, giving additions, changes, and corrections for Domestic Commerce Series No. 5.

Markets for Building Materials, Part II. Mexico, Central America, and the West Indies. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 660. 10 cents.

Leather Trade of Italy. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 661. 10 cents.

Mineral Production Statistics for 1928—separate pamphlets from Bureau of Mines on: Platinum and Allied Metals, by V. C. Heikes; Sulphur and Pyrites, by Robert H. Ridgway; and Slate, by Oliver Bowles and A. T. Coons. 5 cents each.

Sand and Gravel Production Continues to Increase. Bureau of Mines mimeographed press release dated Nov. 8, giving preliminary 1928 production statistics, including figures on glass and other special sands.

Use of Natural Gas Continues to Increase. Bureau of Mines mimeographed press release dated Sept. 24, giving preliminary 1928 production statistics.

Survey of Fuel Consumption at Refineries in 1928, by G. R. Hopkins. Bureau of Mines Serial 2964. Mimeographed.

Survey of Fuel-Oil Distribution, Central United States, 1928, by A. T. Coumbe, Jr. Bureau of Mines Information Circular 6204. Mimeographed.

Production statistics from 1927 Census of Manufactures—printed pamphlets on: asbestos products and stone, clay, and glass industries not covered by separate reports; artificial leather, linoleum and asphalted-felt-base floor coverings, oilcloth; slaughtering and meat packing and related industries; chocolate and cocoa products, confectionery, and chewing gum; milk products—butter, cheese, and condensed and evaporated milk and ice cream; and miscellaneous fiber and textile products. 5 cents each.

Summarized Data of Gold Production, by Robert H. Ridgway. Bureau of Mines Economic Paper 6. 20 cents.

Comparative Study of Engineering Education in the United States and Europe. Bulletin 16. The Society for the Promotion of Engineering Education, New York, June, 1929. 275 pages. Detailed historical and sectional treatise on education of engineers; very thorough and penetrating.

Clay Products and Non-clay Refractories, 1928. Bureau of the Census mimeographed statistical statement.

Crossties and Poles Purchased and Preserved, 1927. Bureau of the Census. 5 cents.

Production statistics from the Census of Manufactures for 1927—printed pamphlets for the following commodities: fertilizers; wall plaster, wall board, and floor composition; cement and concrete products; glass and mirrors; soap; the sugar industries and corn sirup, corn oil, and starch; tin cans and other tinware; paper, pulp (wood and other fiber), pulpwood consumption and wood-pulp production; and lime and marble, granite, slate, and other stone products. 5 cents each.

THE PLANT NOTEBOOK

an exchange for OPERATING MEN

Time-Temperature Relation For Coking Indicated

By R. S. McBride
Assistant Editor, Chem. & Met.

RATE at which coal can be carbonized depends on the temperature to which it is subjected. This relationship has long been known in an empiric way, but no precise or simple mathematical relationship has generally been recognized. There are now available, however, certain data obtained from the investigations of coking and gas-making properties of coal which have been made jointly by the Bureau of Mines and the American Gas Association that are particularly significant. These data are those which have been given in preliminary results by J. D. Davis, of the Bureau, in connection with his reports to the American Gas Association.

The relationship indicated by the Bureau's figures is as follows:

Time, Hours	Temperature Deg. C.
13½	700
10	800
7	900
5	1,050
4½	1,100

A simple calculation shows from these data that the effective temperature head causing heat to flow into the coal apparently is that above 500 deg. C. Thus at 700 deg. there is an apparent effective head of 200 and at 1,050 deg. an effective head of 550. Multiplying the effective head in degrees by the hours consumed to complete the carbonization to a given end point, we note that what might be called the "heating requirement" is constant within the limits of experiment over the entire range of temperature indicated. The results of such multiplication are:

Temperature Deg. C	"Heat Requirement"
700	2,700
800	3,000
900	2,800
1,050	2,750
1,100	2,850

It will be noted that there is a striking constancy in the heat requirement, which indicates that the effective heat is that available above the limiting temperature of 500 deg. C. It is not inferred that this temperature of 500 deg. would be identical for all kinds of apparatus or under all carbonizing conditions, but there is undoubtedly a minimum effective temperature for any particular combination of oven and coal. In view of this constancy which exists in the one condition described, and presumably under commercial conditions also, it should be possible to make fundamental analyses of carbonizing times and temperatures which would be very helpful in selecting the optimum and most efficient combination without extended experimentation and long-time testing at each of the temperatures in which the operators might be interested.

Rapid Determination of Wear Resistance of Grinding Media

By John Gross
and
S. R. Zimmerley

Respectively, Metallurgist and Assistant Metallurgist, U. S. Bureau of Mines, Intermountain Experiment Station, Salt Lake City, Utah

SELECTION of the most economical alloys to be used for balls in grinding mills has always been a difficult problem. The accumulation of data from large-scale operations has been the only guide as to the rate of wear, and the long time required to get results, together with the inability to maintain comparable conditions, has made the comparison of different types of balls difficult.

To determine quantitatively the wear resistance of grinding media, both the amount of grinding accomplished and the amount of wear incident to the grinding must be determined. Recent investigations on quartz have shown that the amount of grinding accomplished is measured by the amount of surface produced in the operation.

The use of quartz as the material to be ground has the advantage that it can be obtained in high purity. Hence by treating with a proper solvent after grinding, the amount of the grinding medium worn off during the test can be determined by chemical analysis. Weighing several hundred pounds of iron balls in an attempt to determine a difference of 1 gram before and after grinding is not feasible, whereas the amount worn off can be determined within a few milligrams by an analysis of the ground product.

Accordingly, a standard test can be used in which a fixed quantity of sized quartz is ground under standard, optimum conditions. Fixed weight and sizes of the grinding media being investigated are to be used, in a ball mill having a liner of different chemical composition from the grinding media. This latter precaution permits the separate determination of ball and liner wear. On completion of the grinding the ground quartz is divided into two parts, one for surface measurements and the other for leaching and analysis of the filtrate for one of the elements of the ball composition. The results so obtained will give the wear of the grinding medium in terms of the amount of grinding that it has actually accomplished. This permits comparison of the grinding resistance of balls of various compositions (or various shapes of the same composition) in a grinding period of less than one-half hour.

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Coating Aluminum With Lime

By Leon McCulloch

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ALUMINUM articles, when boiled with milk of lime containing a little calcium sulphate, are given a fine-grained, closely adherent, dead-white coating which may prove to be an excellent foundation for the application of paints or enamels. The coating probably cannot be recommended for corrosion resistance but it gives a good appearance, and when sized to prevent the spread of ink gives a surface that can be written upon. If alloys of aluminum rather than the pure metal are given the treatment, various shades of gray are obtained.

In applying the coating no electric current is needed. Ten grams each of lime and calcium sulphate (preferably the fully hydrated sulphate) are used for each liter of water. Although the action of the $CaSO_4$ is unknown, it is found to give smooth, adherent coatings which would otherwise be pitted.

As there is apparently deterioration of the bath upon aging, fresh materials should be added each day. The bath is stirred gently and is kept at about the boiling point, although a temperature of 85 deg. C. has given satisfaction. Time for the process may be varied slightly although the coating does not increase appreciably beyond a certain thickness, as is shown by the test of a piece of aluminum foil 0.001 in. thick:

Time, Minutes	Thickness, Inches
0	0.001
15	0.0017
30	0.0018
60	0.0020
240	0.0024

Upon analysis, the coating on a ¼-mil foil was found to consist of Al_2O_3, 54.5 per cent; CaO, 5.75 per cent; SO_3, 10.7 per cent; and water, expelled at 300 deg. C., 29 per cent. The coating is always hydrated as formed, but the water may be removed by baking at 300 deg.

Abstracted from a paper presented by the author before the American Electrochemical Society, Sept. 19, 1929.

EQUIPMENT NEWS *from* MAKER *and* USER

With the Mechanical Engineers at the Power Show

COINCIDENT with the annual meeting of the American Society of Mechanical Engineers, the eighth National Exposition of Power and Mechanical Engineering was held in New York during the week of Dec. 2. New equipment shown in the 500 or more exhibits was not as prolific as it has been in recent years, although a number of pieces of new apparatus with chemical engineering applications were shown for the first time. Several of these new developments have already been described in *Chem. & Met.* and will not again be taken up for that reason. Most of the other new developments in this field are briefly described below. Some of those most significant from a chemical engineering standpoint will be described in greater detail in subsequent issues.

INSTRUMENT manufacturers showed more activity in bringing out new equipment with chemical engineering applications than was evidenced by any other single group. A new recording thermometer of the disk chart type was shown by the Moto Meter Gauge & Equipment Corporation, Long Island City, N. Y. It employs a round case for wall mounting and utilizes a Bourdon expansion element and a liquid-filled capillary system. It is made in the 10-in. size and is available in various ranges from minus 40 to plus 750 deg. F. The Weston Electrical Instrument Company, Newark, N. J., has brought out a heat-flow meter. This is a new adaptation of an old idea and consists of a series of thermocouples mounted in a rubber belt which is fastened about the pipe whose heat loss it is desired to measure. Two plain rubber belts are placed, one on either side of the belt containing the thermocouples and serve to equalize heat flow. The couples are all arranged with their hot junctions at the inner surface of the belt and the cold junctions at the outer surface. In use the thermocouple series is connected to a millivoltmeter which is calibrated directly in B.t.u. per square foot per hour. The instrument is recommended for determining heat loss from insulated steam and process piping. When the heat insulating qualities of the thermocouple belt itself are taken into consideration the method is said to possess a high degree of accuracy.

A new optical pyrometer was shown by the Pyrometer Instrument Company, 15 Howard St., New York. Whereas most optical pyrometers of the disappearing filament type vary the lamp current until the filament disappears against a background of the incandescent object being measured, the new instrument makes use of a circular optical wedge which is turned until the brightness of the radiating source matches the filament. The instrument is entirely self-contained, incorporating a small flashlight battery for operating the light and an ammeter and rheostat for adjusting the lamp current. The total weight of the instrument is 3 lb.

The Foxboro Company, Foxboro, Mass., has developed a new steam flow meter. Meters are built in pressures up to 1,000 lb. per square inch, while those with a specially constructed manometer operate up to 3,500 lb. per square inch. This company also has meters of this type in operation at pressures up to 6,000 lb. per square inch. The meter employs a forged steel manometer in which is a float transmitting motion through a pressure-tight bearing. The meter chart is driven by a synchronous motor clock which also drives a simple form of integrator. The integrator is controlled by a cam which is connected to the pen arm. Once a minute a striker arm moves until it contacts with the cam, which distance is proportional to the instantaneous flow. This results in the addition to the integrator of an increment of flow equalling the total for the past minute.

A LIQUID level gage, said by its makers to be the most accurate instrument ever devised for measuring liquids stored in bulk, was shown by the Liquidometer Corporation, Skillman Avenue and 37th St., Long Island City, N. Y. This instrument employs a weighing beam for measuring directly the pressure head of liquid in a tank. The instrument is intended principally for tanks too large for gaging with the company's standard float gages. The scale is balanced in a manner similar to the ordinary beam scale, but is provided with a device for reading the balancing position, employing a beam of light which magnifies the motion of the scale 500 times.

Several other pieces of apparatus and equipment, not actually instruments, but used in measuring or controlling, were shown. Allen-Bradley Company, Milwaukee, Wis., had a new pressure switch intended for controlling small air compressors and similar equipment. The switch is made in two sizes, for 2 hp. and 5 hp. motors. The pressure at which the switch will cut out the motor may be adjusted manually through a considerable range. Another machine was an automatic sampler for coal and similar lump materials. It is made by the Charleroi Iron Works, Charleroi, Pa. It consists of an inclined tube with a special form of opening in one side, slowly rotated through reduction gears by means of an electric motor. The tube is installed under the head pulley of a belt conveyor, directly in the discharge. The nature of the opening in the tube is such that a representative sample of material, from top to bottom of the pile on the belt, is trapped and discharged to a small crusher with each revolution of the sampler. The speed of sampling may be adjusted to any desired rate.

The Hardinge Company, York, Pa., entered the measuring machinery field with a new constant weight feeder. The machine is made in sizes from 100 lb. to 120 tons per hour. It consists of a hopper beneath which is mounted a short belt conveyor, the latter being pivoted beneath the hopper and counterbalanced by means of a weight. The conveyor acts as its own scale beam and controls the location of a gate, and hence the flow of material from the hopper to the belt.

STILL ANOTHER piece of control equipment was a new throttling valve made by the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. This is an addition to the recently announced line of industrial instruments put out by this company. The new valve employs opposed motors so as to adjust the opening of the valve at any point between fully open and shut, according to the demands of some form of automatic regulator.

In the field of refrigeration a new automatic system was shown by Douglas K. Warner, Bristol, Conn. This system is used in refrigerating cold rooms and operates by freezing water in numerous small pans instead of employing continuous circulation of brine in pipes. It is claimed that this permits a reduction in power requirements and that uniform temperatures may be maintained accurately over considerable periods without operating the ice machine.

At the other end of the heat scale there were, of course, new showings in equipment of particular interest only to the power engineer. Two developments, however, have chemical engineering application. The Yarnall-Waring Company, 102 East Mermaid Lane, Chestnut Hill, Philadelphia, Pa., is building a new expansion joint for pipe lines from 2½ to 24 in. in diameter. This is of the packed, sliding-sleeve type and is constructed entirely of steel, employing a chromium-plated steel sleeve. It is made in both double and single expansion types, in standard and extra heavy construction.

Another piece of equipment for heat handling was originally developed as an auxiliary in the laundry industry. It is

built by the O. E. Frank Heater & Engineering Company, Buffalo, N. Y., and is now suggested for use as a preheater for water or other liquids, employing the waste heat in process liquor. It consists of a tank in which is suspended a series of return bends mounted in headers, each set of bends being connected to the next in the series and separated by baffles. The liquor to be cooled and the feed are intended to flow counter to each other. Any number of return-bend units may be connected in the series.

A NEW rotary strainer with an automatic cleaning feature was shown by the Andale Company, 1600 Arch Street, Philadelphia, Pa. The strainer consists of a segmental wheel in a casing, in each segment of which are mounted cellular straining elements. The wheel is slowly rotated and at the top of its path each segment is isolated in turn by means of a wash box constructed in the casing. Flow of liquids to be strained is through the lower portion of the wheel, while a small part of the strained liquid is conducted back through the wash box, flushing out the strainer. At the present stage of development of this machine a ⅛-in. opening for the strainer is the minimum available.

The power transmission field was represented by three new offerings. The Link-Belt Company, Chicago, has introduced an American modification of the British P.I.V. drive. The original drive of this type, as described in the March, 1927, issue of *Chem. & Met.*, bore a resemblance to the familiar type of variable speed drive in which a pair of opposed cones is mounted adjustably on each of the driving and driven shafts, with the two pulleys thus formed connected by a special type of belt. The drive differed, however, in that the cone faces were grooved and the belt was made of metal, carrying numerous thin, transverse fingers arranged to slide in the belt links so as to mesh with the grooves in the cone faces. This resulted in a positive type of drive. The new Link-Belt machine is a refinement of this and is inclosed so as to make possible continuous, thorough lubrication of the belt.

The Universal Gear Corporation, 327 South La Salle St., Chicago, introduced two new pieces of equipment. One is known as the "Heliocentric" speed reducer and is made in reductions up to 1,000,000 to 1 and sizes up to 50 hp. The high-speed shaft carries an eccentric which drives a series of plungers assembled radially in a spool piece mounted on the low-speed shaft. The plungers engage a stationary internal gear rack and progressively move forward on the rack as the cam operates them. More than one-third of these plungers are always in contact with the internal gear. The second piece of equipment put out by this company is known as the "Revocentric" infinitely variable speed reducer. It employs a variable-throw eccentric mounted on the high speed shaft which drives the low-speed side through five clutches operated by toggle joints. Any speed of the low-speed shaft between zero and one-thirteenth of the input speed may be obtained. Both of these speed reducers are British developments which have just recently been introduced into the United States.

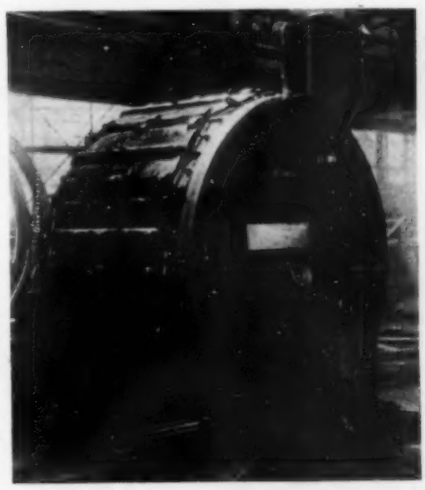
The Bishop "Contact Cable," made by the Bishop Wire & Cable Corporation, Graybar Building, New York, is a continuous switch. It is made in the form of a rubber-covered cable containing two conductors normally held out of contact by means of a rubber isolation cushion. If, however, the cable is pressed at any point, contact is made between the two conductors and the circuit is closed. The cable is intended for uses including ringing a bell or an alarm or operating lights or machinery through the medium of a relay switch. It may be operated by the pressure of any part of the body or the weight of inanimate objects.

A FINAL development, hardly chemical engineering in nature but certainly of very broad application, is the Dardelet self-locking screw thread. This has recently been introduced from France by the Dardelet Threadlock Corporation, 120 Broadway, New York. It resembles the ordinary Acme standard square thread with the difference that lengthwise motion is possible between the screw and the nut. The root of the thread on the screw, however, is tapered between threads, being larger at the front end. This causes the nut to wedge whenever it is pulled up tight. It is claimed that vibration tends only to increase the tightness of the wedging action. Ordinary tools are all that is required to remove the nut at any time.

Salt-Washing Filter

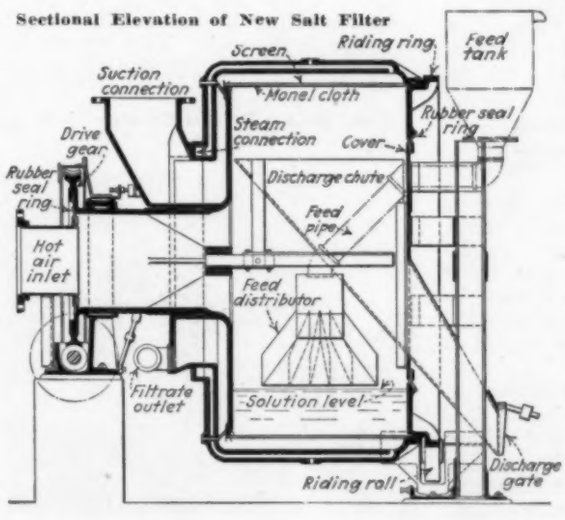
A MODIFICATION of the Dorrco filter, originally described in *Chem. & Met.* in the issue of October, 1927, page 636, is announced by the Dorr Company, 247 Park Ave., New York. The new machine has been designed to filter and dry grainer salt and other coarsely crystalline materials. It operates on the same general principle as the standard machine in that cake formation and discharge are both aided by gravity through the application of the filter medium to the inside of the drum. It differs from the standard Dorrco in that the shell is constructed of cast iron and the filter sections are flat instead of arcs of a circle.

An even more noticeable difference is clearly shown in the accompanying cross-sectional drawing. The trunnion, which serves as the back bearing, and is surrounded by a port valve of special design for making vacuum connections to the filter sections (and air or steam connections if desired), is hollow and is used to admit heated air for drying the filter cake. Other differences lie in the feed and the normally open end of the drum. The latter is blanked off in the new filter by means of a plate sealed by a rubber ring. The feed pipe and discharge chute enter through the plate, the former being terminated with a special distributor. Electrodes may be located in the lower portion of the drum to indicate on a series of electric lights the level of the slurry within the drum. Each of the filter panels carries a Monel metal filter cloth backed by heavy brass screening and is easily removable by loosening four swing bolts and backing off six stud bolts between the panels.



View of Salt Filter From Feed End

Sectional Elevation of New Salt Filter

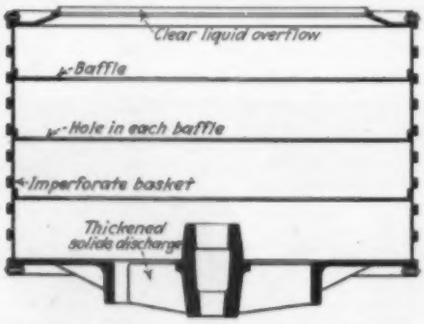


In operation the salt slurry is fed into the filter drum while a vacuum of 4 or 5 in. of mercury is maintained on the lower sections. As the cake emerges from the liquid, heated air is drawn through it, reducing the moisture content to 1½-2 per cent. Under special conditions where the feed temperature

may be kept at about 150 deg. F., the moisture content may be reduced as low as 1 per cent. In the initial installation of this filter, a 6 x 3-ft. unit has been in operation for several months and accomplishes this moisture reduction. The machine is reported to have displaced a battery of centrifugals. The manufacturer recommends the new filter for handling such materials as ammonium phosphate, sodium nitrate and sodium phosphate.

Centrifugal Thickener

A NEW centrifugal machine for thickening difficulty filterable solids in suspension has been developed by the Tolhurst Machine Works, Troy, N. Y.



Special Solid Basket Used in Centrifugal Thickener

The machine employs a standard suspension for the basket with a direct-connected motor and a special imperforate basket containing baffles. The exact arrangement of the baffles is varied to suit individual requirements. In the basket illustrated herewith there are three horizontal baffles, each of which contains a hole spaced 120 deg. from the hole in the adjoining baffle. Thus, when the slurry to be thickened is fed continuously into the lower portion of the basket, it must pass completely around the basket at least once before the clarified liquid is discharged over the top.

The thickener is built in basket sizes of 40 and 48 inches. The 40-in. machine has a total capacity of 6.4 cu.ft., or 51 gal. under the top ring. The 48-in. machine has a total capacity of 10 cu.ft. or 75 gal. under the top ring. The basket may be produced in any practicable material, including rubber-covered metal.

Acid-Proof Cement

ACID-PROOF cements, developed by the German I. G. Farbenindustrie, and used for a number of years in the company's own plants, is now being distributed in the United States by Kuttroff, Pickhardt & Company, 1150 Broadway, New York. The cement is marketed under the name of "Hoechst," and is made in three grades of various degrees of hardness. Grade 20 does not set as hard as grade 25, and neither changes volume during the setting period. Grade 25 is more resistant to water than grade 20. Grade 30 is harder than the other two, but is said to expand readily, thereby setting up internal stresses.

These cements are resistant to all acids except hydrofluoric in all concentrations and at any temperature up to 800 deg. C. They also resist the halogens and ammonia. Grades 20 and 30 will resist neutral salt solutions in water at any concentration and temperature up to 800 deg. provided the lining joints are treated with acid previous to use. Grade 25 is resistant without acid treatment. All of the cements resist alkalis for a short period at normal temperature. They are injured by exposure for periods longer than 15 to 30 minutes and through the action of high temperatures.

These cements are self-hardening and quick-setting. They harden within three days without artificial drying or acid treatment. Because they are not easily squeezed from the joint and due to their rapid hardening, it is claimed that structures of any desired height may be made with their use. They adhere firmly to metals, stone, wood, glass and other similar materials, according to the distributors. They are recommended for use directly as a lining, for laying brick and tile for floors and tank linings and for the construction of flues, chimneys and other brickwork. It is claimed that repairs may be quickly made on such equipment since the cement requires only local neutralization of the old brickwork.

Precast Concrete Slabs

A NEW TYPE of light-weight, insulating-concrete, precast slab for roof construction is announced by the Federal Cement Tile Company, 608 South Dearborn St., Chicago. The new slabs are said to weigh only about ⅓ as much as similar slabs made from sand concrete. At the same time, the thermal conductivity is only about 37 per cent that of sand concrete.

These features are secured by using a material known as Haydite as an aggregate instead of sand and gravel or stone. Shale containing organic matter is ground and burned in rotary kilns, whereupon the expansion of the gases formed produces a light-weight cellular structure in the rock. This material is crushed, screened and graded, making a light-weight aggregate with decided heat-insulating properties.

Light-Weight Precast Concrete Slabs Being Placed

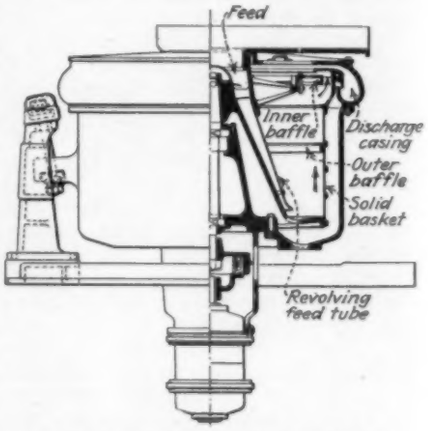
As a result of the light weight of the new slab, which is said to have a strength equal to ordinary concrete, the manufacturers state that roof construction with this product ordinarily requires no heavier steel than is used with other materials.

It is pointed out that ordinarily no additional insulation is required for a roof made of this material. The slabs are easily laid and require only a composition covering. Such a roof, it is claimed, is permanent, fireproof, and prevents condensation.

Paper Stock Cleaner

A RECENT tendency has become evident to employ centrifugal separation in cleaning of paper stock. The "Centrifiner," made by the Bird Machine Company, South Walpole, Mass., is a machine of this type. The accompanying drawing shows its principal features.

The machine is made under the patents of the Centrifugal Engineering and Pump Corporation. It consists of a solid basket, driven from beneath by a direct-connected motor. The mounting for the machine is of the self-balancing type. Paper stuff is fed into



Part Sectional View of Centrifugal Cleaner for Paper Stock

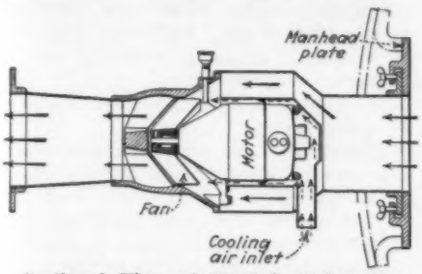
the central feedwell at the top, flowing down through an annular passage of increasing diameter, where it is accelerated to the speed of the basket. It is then thrown against the inner surface of the basket and travels upward, overflowing two baffles which retain any material of density higher than the stock. The stock then flows past an inner baffle, which removes material of density less than the stock, and over a dam at the top of the basket from which it is thrown outward into a stationary volute.

Correction: On page 627 of its October, 1929, issue, *Chem. & Met.* published an article describing the new Pehrson rotary dryer. The article omitted to state that the United States rights for this device are in the hands of Mr. Frank Hodson, 1,015 Chestnut St., Philadelphia, Pa.

Manhole Blower

A RECENT issue of *Chem. & Met.* described the "Heat Killer" made by the Coppus Engineering Corporation, 344 Park Ave., Worcester, Mass. This machine is a small motor-driven blower mounted upon a tripod. Two variations of the earlier machine are also being built for cooling boiler drums, tanks, kettles or other vessels so that they may be entered. One form is designed to direct a blast of air through the manhole of the vessel and the other type is intended to exhaust hot air from the vessel.

Each type is equipped with a special manhead and yoke for mounting in the



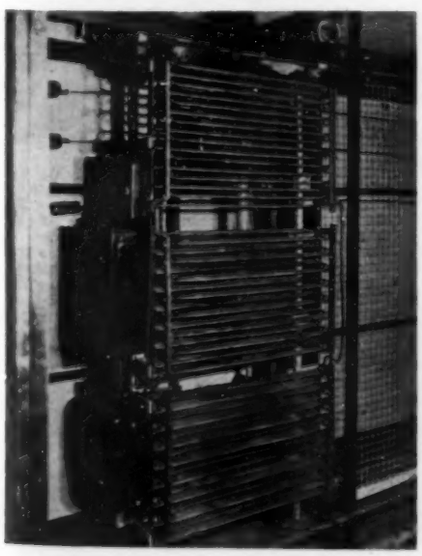
Sectional View of Manhole Exhauster

manhole. Each uses a small fan to move the air, driven by means of a ½-hp. universal motor. The blower (not illustrated) weighs 80 lb. complete. The exhauster, shown in the accompanying drawing, weighs 90 lb. The blower differs in minor details from the exhauster, but principally in that the opposite end is inserted in the manhole. The exhauster, it should be noted, may be used either as a blower or exhauster.

Traveling Fan Carriage

A NEW TYPE of accessory for hot-air dryers, known as the "Dry-Sys Reco" traveling fan carriage, is announced by Drying Systems, Incorporated, 1,800 Foster Ave., Chicago. While the carriage may be varied to suit specific needs, in the last analysis it consists of a framework carrying a number of fans and mounted upon a trolley system which is electrically operated to convey the fan continuously from one end of the drying chamber to the other and back again.

Dryer Carriage Equipped With Fans and Strip Heaters



It is claimed by the manufacturer that this system produces rapid drying at lower cost and with lower drying temperatures, through the action of intermittent turbulence on any specific portion of the drying charge. "Case hardening" is said to be eliminated because of the fact that moisture is permitted to come to the surface of the drying material in the time elapsing between cycles of carriage travel.

The carriage may be arranged to travel along the side wall of the drying chamber or it may travel overhead, projecting the air downward. It may carry its own heating elements as shown in the accompanying photograph. To date it has been applied in drying leather and macaroni, and is suggested for use in tray dryers on various crystalline products and for drying dyes, rayon and textiles, paper, ceramic products and similar material. It is also suggested for circulating air in cooling rooms.

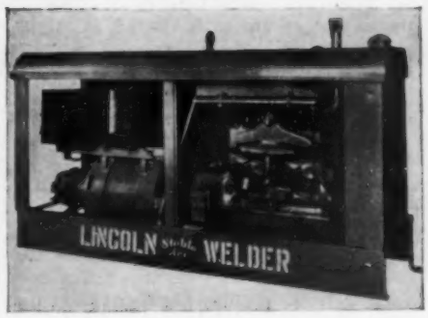
Oxygen Regulator

A TWO-STAGE regulator, intended to eliminate fluctuation in oxygen pressure for gas welding, has been added to the line of the Oxweld Acetylene Company, 30 East 42d St., New York. This is known as type R-109, and consists of two independent stages of pressure reduction. The first stage reduces from full cylinder pressure of about 2,000 lb. to about 175 lb. by means of a non-adjustable valve. The second valve reduces to the desired working pressure. When pressure of the cylinder falls below 175 lb., the first-stage valve remains fully open. This regulator supersedes type R-105, formerly manufactured by this company.

Self-Contained Welder

A NEW gas-engine-driven Stable Arc welder of 200 amperes rating is announced by the Lincoln Electric Company, Cleveland, Ohio. Special features of the new welder include a 4-cylinder Waukesha engine operating at 1,500 r.p.m., an automatic idling device which reduces the gas-engine speed when welding operations cease, and accelerates the engine when welding is again started, and an inclosing canopy which protects the entire outfit. It is said that the automatic idling device will reduce fuel consumption approximately 25 per cent.

The idling device consists of a small metal bellows connected to the intake manifold of the engine. When the arc is struck, an electric magnet opens a relief valve in the bellows causing it to inflate and opening the engine throttle. When welding ceases, the bellows is deflated by the engine suction, closing the throttle to the idling position. A

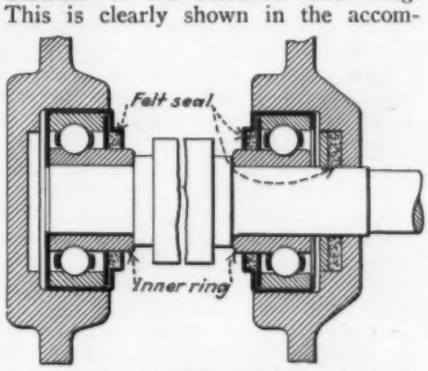


New 200-Ampere Welder With Side Panels Removed

control lever is provided to set the device for automatic throttle control, continuous idling speed, or governed speed. Momentary interruption of the welding will not cause the control to operate to reduce the engine speed.

Self-Sealed Bearing

A SELF-SEALED, self-lubricated ball bearing for small machinery is announced by the New Departure Manufacturing Company, Bristol, Conn. It is known as the N-D-Seal bearing, and consists essentially of a single row ball bearing, permanently fitted into a metal case or shell. One side of the shell is shaped to contain a felt closure which fits over the ground outside diameter of the extended inner ring. This is clearly shown in the accom-



New Bearing for Plain and Through Shafts Shown in Section

panying drawing. The felt serves to retain the lubricant and to exclude dirt.

The new bearing, having an integral closure, occupies less space than bearings in which this feature is separate. Another advantage claimed is that the bearing requires practically no attention, and that it will operate two to five years without the addition of lubricant.

Foot Lift Truck

WHEREAS lift trucks ordinarily are raised by using the handle as a jack lever, the new "Foot Lift" truck manufactured by Lewis-Shepard Company, 176 Walnut St., Watertown Station, Boston, Mass., makes use of a foot-operated lever to lift loads up to 3,500 lb. Advantages claimed for the new truck include smaller operating space, easier lifting, greater safety, and quicker action. It is said that this

truck can be operated twice as rapidly as the usual hand-lift truck. Pressure lubrication, roller bearings, simple and heavy construction are said to be important features of the new truck.

New Color Analyzers

INSTRUMENTS for the very accurate analysis of light reflected from or transmitted by various substances such as oils, paints, pigments and dyes have recently been announced by the American Photoelectric Corporation, 215 Third Ave., New York. Briefly, the reflected or transmitted light is analyzed by means of a spectrometer and the light intensity of a number of narrow bands of the spectrum is measured by absolute methods, using a photoelectric cell. A sufficient number of bands is measured to permit the plotting of an accurate curve of intensity vs. wave length over the color range.

Measurement of a single point on the curve may be made in about 15 seconds by a non-technical operator of average intelligence, while a complete analysis requires up to 5 minutes.

Whereas previous spectrophotometric methods for use in colorimetry have made use of a standard white as a basis of comparison, the new instruments give an absolute measurement, independent of variations in either the source of light or the photoelectric cell. A description of the simplest of these will show how this is accomplished.

The instrument uses as a source of light a small incandescent lamp operated by a storage battery. There are in addition, a spectrometer, a slide carrying a sample to be analyzed by transmitted light, a box containing the photoelectric cell and the greater part of the electrical circuit, one side of the box carrying the control panel, and finally, a Wheatstone bridge of the Kohlrauch type which is balanced with the assistance of a galvanometer. Light from the source enters the spectrometer where a spectrum band about 5 millimicrons wide is isolated by means of a slit and allowed to fall upon the sample slide. The slide may be moved to three positions. The first permits the passage of no light and enables the operator to adjust the instrument for zero intensity. The second position interposes an unobstructed opening between the spectrometer and the photoelectric cell, whereupon the operator makes an adjustment for 100 per cent light intensity of the wave length being measured. The third position places the sample in the path of the light. When the bridge is balanced in this position, the reading is a measure of the intensity of the transmitted light in relation to zero and 100 per cent intensity of the same wave length as supplied by the source. The bridge is calibrated to read directly in per cent of total intensity of the light from the source. This explains the absolute nature of the measurements and accounts in part for the accuracy of the method which is said to be correct to 0.1 per cent.

Further variations of the instrument are available for other types of color analysis. One makes use of what is known as an opaque illuminator for analyzing the reflected light of opaque samples, while a second employs an ultra-violet light source and a quartz-prism spectrometer for the examination of specimens under the influence of wave lengths shorter than the visible.

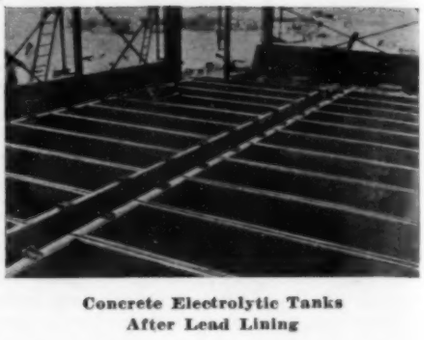
Concrete Electrolytic Cells

AN EXTENSIVE installation of concrete tanks intended for electrolytic cells has been made by the Cement-Gun Construction Company, 537 South Dearborn St., Chicago. This installation was made for the Nichols Copper Company, at El Paso, Texas. The installation consists of 72 concrete tanks. Each tank is divided into 16 cells by 15 partitions. The tanks are approximately 68 ft. long, 14 ft. wide, and 4 ft. 6 in. deep. Each is supported on 32 concrete columns, 12 in. square by 6 ft. high, from which the tanks are insulated by glass plates 1 in. thick.

The tank walls are 4 in. thick, and are heavily reinforced with rods. Each tank is lined with ½-in. sheet lead, and for additional acid resistance the concrete contains as much silica as possible.

A suitable silica sand was not available, and artificial sand was made from silica rock quarried in Mexico and crushed to suitable size for fines and aggregate. This installation suggests the possible use of concrete construction lined with lead or other acid-resisting material for many types of electrolytic equipment.

View of Portion of Electrolytic Cell Room During Construction



Concrete Electrolytic Tanks After Lead Lining

Manufacturers' Latest Publications

Electrical Equipment. General Electric Co., Schenectady, N. Y.—Publications are as follows: GEA-847A, induction differential relay; GEA-974B, oil circuit breakers; GEA-1105A, undervoltage devices; GEA-1130, turbine-generator sets, direct current; GEA-1145, 16 pages on mechanical-drive turbines; GEA-1170, synchronous motors in paper mills; GEA-1171, synchronous motors in mining; GEA-1172, super synchronous motors for large grinding and pulverizing mills; GED-309, describes new G-E Fiberduct for underfloor wiring.

Electrical Equipment. Westinghouse Electric & Manufacturing Co., Newark, N. J.—Leaflet No. 20433—Describes a detachable watthour meter for outdoor and indoor use.

Heating. General Iron Works Co., Cincinnati, Ohio—Bulletin describing the "Hot-Kold" suspended and floor type central heating systems for industrial and domestic use made by this company.

Instruments. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.—Folder describing some of the indicating and recording galvanometers made by this company.

Lighting. Edison Lamp Works, Harrison, N. J.—Bulletin LD-159—49 page booklet describes various applications of flood lighting, giving very complete information on methods for calculating requirements.

Liquid Handling. Hills-McCanna Co., 2349 Nelson St., Chicago, Ill.—Folder describing the Young bottom outlet valve for tank cars and its method of operation.

Material Handling. The Fuller Co., Catasauqua, Pa.—Bulletin briefly describing the "Airveyor" pneumatic handling system recently acquired by this company.

Material Handling. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill.—Book No. 1004—Describes the rotary railroad car dumper made by this company.

Material Handling. Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.—36-page booklet describing installations of Shepard electric hoists.

Pipe Fittings. Stockham Pipe & Fittings Co., Birmingham, Ala. — Catalog H — New catalog of 359 pages on fittings made by this company. Includes dimension data.

Piping. Tube-Turns, Inc., Louisville, Ky. —Bulletin 105—Describes pipe welding with the stock fittings made by this company, in a new power plant for the U. S. Bureau of Standards.

Power Transmission. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill.—Bulletin 1257—96-page book giving data and applications on roller chains for light and heavy duty industrial drives.

Screens. Ludlow-Saylor Wire Co., St. Louis, Mo.—Section 4, reprinted from "Getting Results With Ludlow-Saylor Screens," giving in 36 pages reference data on double crimped wire cloth and woven wire screens. Several hundred screens are listed.

Steam Generation. Combustion Engineering Corp., 200 Madison Ave., New York—Reprint describing test of a boiler in the East River Station of the New York Edison Co.

Steam Generation. H. O. Swoboda, Inc., Pittsburgh, Pa.—Bulletin 180—Reprint describing tests made upon various types of coal available to a client for power generation.

Steam Generation. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.—Leaflet EJ-1901—Describes and gives complete list of sizes and dimensions of a new line of cylinder-guided expansion joints.

Welding. Lincoln Electric Co., Cleveland, Ohio — Publications as follows: Bulletin G-15, ten-page pamphlet on the use of arc welding in more than 3,000 miles of pipe lines. Also Specification Bulletins S-1931A, S-1932A, S-1935A, S-1936A, S-1964A, S-1459A, dealing with 300-amp. Stable-Arc welders, portable and stationary, for alternating- and direct-current drives, and for gasoline-engine and belt drives. Also nine data sheets published monthly during 1929: "Studies in Structural Welding," giving information on various types of building construction.

West Virginia. W. Va. Department of Agriculture, Charleston, W. Va.—A 24-page book describing industrial, marketing and transportation conditions, as well as natural resources of West Virginia.

PATENTS ISSUED
Oct. 29 to Nov. 26, 1929

Paper, Pulp and Glass

Glass-Forming Machine. Leonard D. Soubier, Toledo, Ohio, assignor to Owens-Illinois Glass Company, Toledo, Ohio.—1,733,473.

Producing Sheet Glass. Nicklas Franzen, Long Beach, Calif., assignor to Mississippi Glass Company, New York, N. Y.—1,734,-250.

Method and Apparatus for Bleaching Pulp. Albert D. Merrill, Watertown, N. Y., assignor, by mesne assignments, to International Bleaching Corporation.—1,734,632.

Paper-Making Machine. Robert E. Read, White Plains, N. Y., assignor to International Paper Company.—1,734,879.

Paper-Making Machine. John Warren Vedder, Worcester, Mass.—1,734,929.

Process of Pulping Raw Cellulosic Material. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H. —1,735,013-5.

Process for Opening up Materials Containing Cellulose. Heinrich Heimann and Hermann Seefried, Dessau in Anhalt; Irnfried Petersen, Wolfen, Kreis Bitterfeld, and Alfons Bayerl, Dessau in Anhalt, Germany, assignors to I. G. Farbenindustrie Aktienegesellschaft, Frankfort-on-the-Main, Germany.—1,736,080.

Process for Improving Cotton. Leon Lilienfeld, Vienna, Austria.—1,736,712-3.

Apparatus for Screening Paper Stock. Andrew J. Brookover, Downingtown, Pa.—1,737,296.

Production of Paper. Donald K. Pattillo, Fulton, and James H. MacMahon, Niagara Falls, N. Y., assignors, by direct and mesne assignments, to Mathieson Alkali Works, Inc., New York, N. Y.—1,737,330.

Process of Making Wood Pulp. William Brydges and Spottswood C. Foster, Big Island, Va., assignors to Bedford Pulp & Paper Company, Inc., Big Island, Va.—1,737,542.

Bleaching Fiber Pulp. Horatio A. Helder, Canton, N. C., assignor to Champion Fibre Company, Canton, N. C.—1,732,511.

Paper-Feeding Means for Paper-Making Machines. Russell Carpenter, Three Rivers, Quebec, Canada.—1,732,833.

Operation of Paper Mills. Donald K. Pattillo, Fulton, and James H. MacMahon, Niagara Falls, N. Y., assignors, by direct and mesne assignments, to Mathieson Alkali Works, Inc., New York, N. Y.—1,733,070-1.

Rubber, Rayon and Synthetic Plastics

Cellulose Condensation Product and Process for Making Same. Erich Gebauer-Fuelnegg, Vienna, Austria, assignor to E. I. duPont de Nemours & Company, Wilmington, Del.—1,734,291.

Method of Vulcanizing Rubber and Resulting Products. Henry B. Morse, Danvers, Mass., assignor, by mesne assignments, to Albert C. Burrage, Jr., Ipswich, Mass.—1,734,633-40.

Pyroxylin Composition. Robert H. Van Schaack, Jr., Evanston, Ill., assignor to Van Schaack Bros. Chemical Works, Inc., Chicago, Ill.—1,734,657.

Age-Resisting Compound for Vulcanized Rubber. Max H. Zimmermann, Newington, N. H., assignor, by mesne assignments, to Albert C. Burrage, Jr., Ipswich, Mass.—1,734,951-3.

Process of Manufacturing Furfural. Carl S. Miner, Chicago, Ill., and Harold J. Brownlee, Cedar Rapids, Iowa, assignors to Quaker Oats Company, Chicago, Ill.—1,735,084.

Manufacture of Rubber Compositions and Products Obtained Thereby. James H. Reel, Jackson Heights, and Harold E. Cude, Floral Park, N. Y., assignors to Naugatuck Chemical Company, Naugatuck, Conn.—1,735,547.

Method of Molding Synthetic Resins. Frank H. Benge, Norristown, and Robert R. Titus, Vilianova, Pa., assignors, by mesne assignments, to Continental-Diamond Fibre Company, Newark, Del.—1,735,668.

Method of Molding an Article Produced From Plastic Material in Imitation of Onyx, Agate, Marble, and the Like. Harry N. Copeland, Dayton, Ohio, assignor to Kurz-Kasch Company, Dayton, Ohio.—1,735,674.

Synthetic Material Adapted to the Plastic Art. Clarence A. Nash, Milwaukee, Wis., and John P. Trickey, Evanston, and Carl S. Miner, Glencoe, Ill., assignors, by direct and mesne assignments, to Quaker Oats Company, Chicago, Ill.—1,736,047.

Condensation Product of the Anthraquinone Series and Process of Making Same. Georg Kränzlein and Robert Sedlmayr, Hochst-on-the-Main, Germany, assignors to General Aniline Works, Inc., New York, N. Y.—1,736,084.

Process of Manufacturing Artificial Silk and the Like. Harry P. Bassett, Cynthiana, Ky., and Thomas F. Banigan, Clifton Heights, Pa., assignors, by mesne assignments, to said Bassett.—1,736,280.

Process for Treating Rubber Latex Compositions and Articles Formed Thereby. Ernest Hopkinson, New York, and Merwyn C. Teague, Jackson Heights, N. Y., assignors to American Rubber Company, East Cambridge, Mass.—1,736,404.

Rotatable Piston Pump Available for Viscose. Leon Jacot-Descombes, Tavannes, Switzerland.—1,736,497.

Manufacture of Artificial Threads, Filaments, and the Like. Charles Fred Topham, Edward Hazeley, and Eric Andrew Morton, Coventry, England, assignors to Courtaulds, Ltd., London, England.—1,736,-681.

Reaction Products of a Natural Resin-Phenolic Resinous Material and Method of Making Same. August Amann, Wiesbaden, Germany, assignor to Chemische Fabriken Dr. Kurt Albert G. m. b. H., Biebrich-on-the-Rhine-Amoeneburg, Germany.—1,736,-757.

Phenol - Formaldehyde Condensation Product and Method of Making Same. George W. Stryker, Los Angeles, Calif.—1,737,031.

Apparatus for Marking Rubber and Rubberized Material. Charles H. Desautels, Springfield, Mass., assignor to Fisk Rubber Company, Chicopee Falls, Mass.—1,737,111.

Phenol-Furfural Resin and Method of Making Same. Emil E. Novotny, Logan, Pa., assignor to John Stogdell Stokes, Spring Valley Farms, Huntingdon Valley P. O., Pa.—1,737,121.

Moistureproof Material. William Hale Charch and Karl Edwin Prindle, Buffalo, N. Y., assignors, by mesne assignments to duPont Celiophane Company, Inc., New York, N. Y.—1,737,187.

Nitrocellulose Composition. John C. Emhardt, Newburgh, N. Y., assignor to E. I. duPont de Nemours & Company, Wilmington, Del.—1,737,364.

Manufacture of Aldehyde-Amine Reaction Products. Clayton Olin North and Winfield Scott, Akron, Ohio, assignors to Rubber Service Laboratories Company, Akron, Ohio.—1,737,384.

Manufacturing Derivatives of Aldehyde-Amine Reaction Products. Winfield Scott, Akron, Ohio, asignor to Rubber Service Laboratories Company, Akron, Ohio.—1,-737,391.

Process of Vulcanizing Rubber and Accelerator Therefor. Donald Howard Powers, Wilmington, Del., assignor to E. I. duPont de Nemours & Company, Wilmington, Del.—1,732,532.

Molding Mixture. Lawrence V. Redman, Caldwell, N. J., assignor to Bakelite Corporation, New York, N. Y.—1,732,533.

Rubber Vulcanization Accelerator. Clayton Olin North, Akron, Ohio, assignor to Rubber Service Laboratories Company, Akron, Ohio.—1,732,770.

Manufacture of Rubber Compositions. Lorin B. Sebrell, Akron, Ohio, assignor to Goodyear Tire & Rubber Company, Akron, Ohio.—1,732,774.

Synthetic Rubber and Method of Making It. Ray P. Dinsmore, Akron, Ohio, assignor to Goodyear Tire & Rubber Company, Akron, Ohio.—1,732,795.

Petroleum Refining and Products

Combined Process of Distilling, Cracking, and Gas Making, and Apparatus Therefor. Alfred Schwarz, Montclair, N. J.—1,733,135.

Process and Apparatus for Making White Petrolatum. August Holmes, Newark, N. J. assignor to Standard Oil Development Company.—1,733,597.

Art of Cracking Hydrocarbons. Eugene C. Herthel, Chicago, Ill., and Harry L. Pelzer, Highland, Ind., assignors to Sinclair Refining Company, New York, N. Y.—1,733,799-800.

Cracking Still. George L. Prichard and Herbert Henderson, Port Arthur, Texas, assignors to Gulf Refining Company, Pittsburgh, Pa.—1,734,827.

Apparatus for Refining Crude Petroleum. Frederick Garthewaite Ring, Winchester, Mass., and Percy George Paris, Bethlehem, Pa.; said Paris assignor to Bethlehem Steel Company.—1,734,880.

Apparatus for Clarifying and Decolorizing Petroleum Oil. John C. Black, Los Angeles, Calif., assignor, by mesne assignments, to Contact Filtration Company, San Francisco, Calif.—1,734,959.

Process of Coking Oils. Thomas Cox, Oakland, and Mark L. Requa, Piedmont, Calif., and Alexander S. Knowles, New York, N. Y.; said Cox and said Knowles assignors to said Requa.—1,735,421.

Art of Treating Hydrocarbons. John F. Johnson, Westfield, N. J., assignor to Standard Oil Development Company.—1,-735,462.

Process for the Treatment of Hydrocarbons. Philip L. Young, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,735,486.

Art of Refining Hydrocarbons. Frank A. Apgar, East Chicago, Ind., assignor to Sinclair Refining Company, New York, N. Y.—1,735,988.

Art of Refining Hydrocarbons. Thomas de Colon Tifft, Chicago, Ill., and Arnold C. Vobach, Whiting, Ind., assignors to Sinclair Refining Company, New York, N. Y.—1,736,022.

Art of Refining Hydrocarbons. Arnold C. Vobach, Whiting, Ind., assignor to Sinclair Refining Company, New York, N. Y. —1,736,234.

Process for Manufacturing Lubricating Grease. Walter Victor Atkinson, Berkeley, Calif., assignor, by mesne assignments, to Standard Oil Company of California, San Francisco, Calif.—1,736,302.

Fractional-Distillation Apparatus. Richard B. Chillas, Jr., Philadelphia, Pa., assignor to Atlantic Refining Company, Philadelphia, Pa.—1,736,845.

Production of Hydrocarbons from Oil Shale. August P. Bjerregaard, Okmulgee, Okla., assignor to Doherty Research Company, New York, N. Y.—1,732,219.

Purifying Oil. Martin Luther and Kurt Pieroh, Mannheim, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort, Germany.—1,732,371.

Coal Processing and Products

Coking Process. Heinrich Koppers, Essen-Ruhr, Germany, assignor to Koppers Development Corporation, Pittsburgh, Pa. —1,733,307.

Gas Purification Process and Apparatus. Frederick W. Sperr, Jr., Pittsburgh, Pa., assignor to Koppers Company, Pittsburgh, Pa.—1,733,321.

Gas-Producing Apparatus and Process. John J. OConnor, Chicago, Ill.—1,733,621-3.

Gas-Purification Process. Frederick W. Sperr, Jr., Pittsburgh, Pa., assignor to Koppers Company, Pittsburgh, Pa.—1,734,307.

Gas Producer. Reinhardt Daae, Youngstown, Ohio.—1,735,380.

Process for Distilling Solid Carbonaceous Material. Stanley Hiller, Oakland, Calif., assignor to Stanley Hiller, Inc., Oakland, Calif.—1,735,394-7.

Carbonaceous Briquette and Process of Making the Same. Hugh F. Rippey, Glenn Davidson, Charles N. Cone, Irving F. Laucks, and Harry P. Banks, Seattle, Wash.—1,735,506.

Process and Apparatus for Controllably Feeding Gases. Jasper M. Rowland, Niagara Falls, N. Y., assignor to Hooker Electrochemical Company, New York, N. Y. 1,736,509.

Process for Gas Purification and Regenerating Sulphided Alkaline Solutions. Ralph A. Morgen, Oakland, and Willis S. Yard and Ludwig Rosenstein, San Francisco, Calif., assignors, by mesne assignments, to Koppers Company.—1,732,905.

Organic Processes

Soap. Hector Eulalio Crocco, Buenos Aires, Argentina.—1,733,150.

Process for Refining Raw Carbon Disulphide. Philipp Siedler, Griesheim-on-the-Main, and Eugen Schulte, Schwanheim-on-the-Main, Germany, assignors to the Firm I. G. Farbenindustrie, Frankfort, Germany. —1,733,171.

Manufacture of Synthetic Camphor. Lucien Dupont, Vincennes, France.—1,733,-218.

Method of Isolating Alcohols or Phenols from Mixtures. Franz Otto Zeitschel, Hamburg, Germany.—1,733,440.

Bituminous Emulsion and Production. Lester Kirschbraun, Chicago, Ill.—1,733,-493-8.

Derivative of Ethylene Glycol. Robert H. Van Schaack, Jr., and Robert Calvert, Chicago, Ill., assignors to Van Schaack Bros. Chemical Works, Inc.—1,733,639.

Manufacture of Alcohol and Ether. Carnie B. Carter, Pittsburgh, Pa., assignor to S. Karpen & Bros., Chicago, Ill.—1,733,-720-1.

Process of Condensing Organic-Compounds by Means of Aluminum Chloride. Alois Zinke, Graz, Styria, Austria, assignor to Felice Beusa, Genoa, Italy.—1,733,768.

Procedure for the Preparation of Hydrogenated Naphthalene. Walther Schrauth, Rosslau, Anhalt, Germany, assignor to Newport Manufacturing Company, Carrollville, Wis.—1,733,908-9.

Process of Producing Benzoic Acid. George Barsky, New York, N. Y., and Isaac V. Giles, Elizabeth, N. J., assignors to American Cyanamid Company, New York.—1,734,029.

Sulphonic Body. Charles Fischer, Jr., Wyoming, and Warren T. Reddish, Cincinnati, Ohio, assignors to Twitchell Process Company, Cincinnati, Ohio.—1,734,369.

Production of Aqueous Dispersions, Lester Kirschbraun, Leonia, N. J.—1,734,437.

Manufacture of Active Carbons. Edouard Urbain, Paris, France, assignor to Urbain Corporation.—1,735,096.

Process for Producing Simultaneously Formates and Gaseous Mixtures Rich in Hydrogen. Georges Claude, Paris and Albert Henri Gosselin, Montereau, France, assignors to La Société Chimique de la Grande Paroisse, Azote & Produits Chimiques, Paris, France.—1,735,107.

Cellulose-Ether Composition. Stewart J. Carroll, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,735,156-9.

Method of Making Carbolic Acid. Stewart Joseph Lloyd, University, and Absalom Mason Kennedy, Montgomery, Ala., assignors to Federal Phosphorus Company, Birmingham, Ala.—1,735,327.

Production of Carbon Disulphide. Mathias Pier, Heidelberg, and Karl Winkler, Ludwigshafen-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,735,409.

Process for the Manufacture and Production of Acetic Acid Anhydride from Acetic Acid. Friedrich August Henglein, Cologne-Deutz, and Franz Schleicher, Wiesdorf-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengeselischaft, Frankfort-on-the-Main, Germany.—1,735,433.

Varnish. Hyym E. Buc, Roselle, N. J., assignor to Standard Oil Development Company.—1,735,493.

Manufacture of a Ceresine-Like Wax. Gerald L. Wendt and Clifford Banta, Chicago, Ill., assignors to Standard Oil Company, Whiting, Ind.—1,735,555.

Catalytic Oxidation of Organic Compounds. Alphons O. Jaeger, Crafton, Pa., assignor to Selden Company, Pittsburgh, Pa.—1,735,763.

Manufacture of Acetic Anhydride. Henry Dreyfus, London, England.—1,735,956-8.

Manufacture of an Aliphatic Compound. Henry Dreyfus, London, England.—1,735,959-62.

Process of Preparing Absorptive Carbon. Arthur B. Ray, Flushing, N. Y., assignor to Carbide & Carbon Chemicals Corporation.—1,736,051.

Protection of Aldehydes from Oxidation and Agents Therefor. Harold A. Morton, Akron, Ohio.—1,736,747.

Method of Making Methylamine. George Barsky, New York, N. Y., assignor to American Cyanamid Company, New York, N. Y.—1,736,872.

Suspension Composition. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company.—1,737,006.

Production of Menthol. Walter Schoeller, Berlin-Charlottenburg, Hans Jordan, Berlin-Steglitz and Reinhard Cleric, Berlin, Germany, assignors to Schering-Kahlbaum A.-G., Berlin, Germany.—1,737,272.

Process of Refining Fatty Oils. Eugene E. Ayres, Jr., Chester, and Lee H. Clark, Philadelphia, Pa., assignors to Sharples Specialty Company, Philadelphia, Pa.—1,737,402.

Process for Obtaining Soap. Grigori Petroff, Moscow, Russia.—1,732,656.

Separation or Alcohols from Polymers. Robert M. Isham, Okmulgee, Okla., assignor to Doherty Research Company, New York, N. Y.—1,732,894.

Separation or Heavy Alcohols from Polymers. Sylvan R. Merley, Dover, N. J., assignor to Doherty Research Company, New York, N. Y.—1,732,903.

Inorganic Processes

Method of Producing Pure Acids. Hermann Frischer, Cologne-Lindenthal, Germany.—1,733,152.

Zinc-Reduction Apparatus and Process. Heinrich Koppers, Essen-Ruhr, Germany, assignor to Koppers Development Corporation, Pittsburg, Pa.—1,733,500.

Recovery of Vanadium. Royale Hillman Stevens, Gerald Chad Norris, and William Nelson Watson, Broken Hill, Northern Rhodesia, South Africa, assignors to Rhodesia Broken Hill Development Company, Ltd., Broken Hill Northern Rhodesia.—1,733,700

Process of Purifying Caustic Soda. Albert H. Hooker and William Judson Marsh, Niagara Falls, N. Y., assignors to Hooker Electrochemical Company, Niagara Falls, N. Y.—1,733,879.

Method of Treating Sulphur. Edward F. White, Rochester, N. Y.—7,734,066.

Process of Making Aluminum Chloro-Sulphate. Henry Blumenberg, Jr., Moapa, Nev.—1,734,196.

Process of Making Aluminum Chloride. Amos M. Buley, Los Angeles, Calif., and Henry Blumenberg, Jr., Moapa, Nev.—1,734,200.

Process for Making Lead Compounds. Chester H. Braselton, New York, N. Y.—1,734,285.

Sodium Cyanide Compound and Process of Producing the Same. Kenneth F. Cooper, Great Neck, N. Y.—1,734,562.

Process for the Preparation of Mixtures of Carbon Monoxide and Hydrogen from Hydrocarbons. Luigi Casale, deceased, Rome, Italy, by Maria Casale-Sacchi, administratrix, Rapalio-Genoa, Italy.—1,734,559.

Bonded Refractory. John D. Morgan, Maplewood, N. J., assignor to Doherty Research Company, New York, N. Y.—1,734,595.

Process of Coating Metallic Aluminum or Aluminum Alloys with Aluminum Oxide Skin. Tsunetaro Kujirai, Nakano-Machi, Toyotama-Gori and Sake Ueki, Oji-Machi. Kitatoshima-Gori, Tokyo Prefecture, Japan.—1,735,286.

Process and Apparatus for the Manufacture of Nitric Acid. Guy B. Taylor and Fred C. Zeisberg, Wilmington, Del., assignors to E. I. duPont de Nemours & Company, Wilmington, Del.—1,735,342.

Process of Producing Reduction Products of Carbon Dioxide. Alphons O. Jaeger, Crafton, Pa., assignor to Selden Company, Pittsburgh, Pa.—1,735,925.

Process of Carrying on Catalytic Reactions. Frank A. Canon and Chester E. Andrews, Pittsburgh, Pa., assignors to Selden Research & Engineering Corporation, Pittsburgh, Pa.—1,735,951.

Process of Producing Hydrogen. Roger Williams, Wilmington, Del., assignor to duPont Ammonia Corporation, Wilmington, Del.—1,736,065.

Process for Producing Pigmentary Base Products for Lead Paints. Axel Viggo Blom, Grosshoechstetten, Switzerland.—1,736,066.

Separation of Minerals and Other Substances. Thomas Malcolm Davidson, Hatch End, Middlesex, England.—1,736,111.

Method of Purifying Crude Sodium Sulphide and the Product Thereof. René Botson, Auderghem-Brussels, Belgium.—1,736,741.

Method of Making Refractories. Robert L. Frink, Lancaster, Ohio.—1,736,909.

Method of Treating Greensand and the Like. Arthur J. Moxham, Great Neck, N. Y., assignor, by mesne assignments, to J. P. Laffey, trustee, Wilmington, Del.—1,737,263.

Process of Production of Alkali Carbonates and Ammonia by Saponification of Calcium Cyanamide. Max Buchner, Hanover-Kleefeld, Germany.—1,737,297.

Contact Process for Manufacturing Sulphuric Acid. Henry F. Merriam, West Orange, N. J., assignor to General Chemical Company, New York, N. Y.—1,737,320.

Chemical Engineering Processes and Equipment

Process and Apparatus for Defecating Liquid. Ashur U. Wetherbee, Evanston, Ill., assignor to Gilchrist & Company.—1,733,324.

Cooling Apparatus. George E. Cox, Niagara Falls, N. Y., assignor to American Cyanamid Company, New York, N. Y.—1,733,582.

Distillation Apparatus. Charles V. McIntire, East Orange, N. J., assignor to Consolidation Coal Products Company, Wilmington, Del.—1,733,747.

Coating for Wood, Metal, or Other Surfaces and Process for Making the Same. Charles H. Holman and Oscar W. Hooppaw, St. Louis, Mo.—1,734,130.

Heat-Exchange Apparatus. Friedrich Schubart, Monterey, Mexico.—1,734,274.

Desiccation Apparatus. Walter H. Dickerson, East Orange, N. J., assignor to Industrial Waste Products Corporation, Dover, Del.—1,734,289.

Tubular Filter Press. Hugh Harley Cannon, Los Angeles, Calif., assignor to Oliver United Filters, Inc.—1,734,325.

Method of Heating and for Controlling Chemical Reactions at High Temperatures. Crosby Field, Yonkers, N. Y., assignor to Chemical Machinery Corporation.—1,734,329.

Art of Refining Borates. William A. Gale and Charles Fisher Ritchie, Trona, Calif., assignors, by mesne assignments, to American Potash & Chemical Corporation, New York, N. Y.—1,732,806.

Rotary Kiln. Arthur J. Briggs, Syracuse, N. Y., assignor to Industries of America, Inc.—1,734,417.

Gas and Liquid Separator. Lester L. Westling and Millard R. Hickman, Oakland, Calif.—1,734,507.

Inhibitor. Ludwig J. Christmann, Jersey City, N. J., assignor to American Cyanamid Company, New York, N. Y.—1,734,560-1.

Mechanical Removal of Solids from Clarification Tanks, etc. Weston Gavett, Plainfield, N. J.—1,734,967.

Pressure Filter for Liquids. Nathan Lanes, New York, N. Y.—1,735,007.

Process and Apparatus for Fractional Condensation. Frank D. Fenhagen, Fairmont, W. Va., and Frederick H. Rhodes, Ithaca, N. Y., and Theodore M. Hesser, Germantown, Pa., assignors to Barrett Company.—1,735,455.

Loading Tank Cars and the Like. Harry C. Wiess, Houston, Tex., assignor to Humble Oil & Refining Company, Houston, Tex.—1,735,484.

Air Separator. Thomas J. Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Company, Boston, Mass.—1,735,479.

Process for Rustproofing Articles of Iron and Steel. William H. Allen, Detroit, Mich., assignor, by mesne assignments, to Parker Rust Proof Company, Detroit, Mich.—1,735,842.

Process in the Manufacture of Electrodes. Mathias Ovrom Sem, Buffalo, N. Y., and Carl Wilhelm Söderberg, Oslo, Norway, assignors to Det Norske Aktieselskab for Elektrokemisk Industri of Norway, Oslo, Norway.—1,735,936.

Evaporator. Philip B. Sadtler, Chicago, Ill., assignor to Swenson Evaporator Company, Harvey, Ill.—1,735,979-80.

Crystallization Process. Arthur W. Allen, Berkeley, Calif.—1,735,987.

Pulverizer. Horace Waring, Liverpool, England, assignor to Associated Lead Manufacturers, Ltd., London, England—1,735,985.

Treatment of Hides. Otto Röhm, Darmstadt Germany.—1,735,977.

Continuous Centrifugal Machine. Theodor Langenberg, Berlin, Germany, assignor to the Firm C. A. Fesca & Sohn, Berlin-Lichtenberg, Germany.—1,736,349.

Deoxidizer. Clarence J. Rodman and Aylmer H. Maude, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company.—1,736,464.

Conveying Apparatus. George Ralph Baker, London, England, assignor to Baker Perkins Company, Inc., New York, N. Y.—1,736,517.

Rotary Pump. Byron E. Parks, Walker Township, Kent County, Mich.—1,736,666.

Apparatus for Sterilizing Air. Joseph F. Schiller and Walter W. Wescott, Philadelphia, Pa., assignors of two-thirds to said Walter W. Wescott.—1,736,839.

Electrodepositing Apparatus. William W. McCord, Wyandotte, Mich., assignor to McCord Radiator & Manufacturing Company, Detroit, Mich.—1,736,857.

Drier. Nicholas Panzireff, Moscow, Russia.—1,736,980.

Protection of Metallic Surfaces Against Incrustation and Corrosion. Walter Thalhofer, Vienna, Austria, assignor to A. G. für Chemische Industrie in Liechtenstein, Schaan, Liechtenstein.—1,736,986-7.

Sintering Apparatus. Edwin E. Ellis, Short Hills, N. J.—1,737,007.

Conveying Apparatus. Sidney E. Meyers, Buffalo, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,737,090.

Feeding Device for Retorts. Richard B. Parker, Skaneateles, N. Y., assignor to Samuel E. Darby, trustee, New York, N. Y.—1,737,170.

Attrition Mill. Edward M. Brennan and Allan P. Daniel, Springfield, Ohio, assignors to Bauer Brothers Company, Springfield, Ohio.—1,737,183.

Process and Apparatus for Drying Coramic Ware. William J. Miller, Swissvale, Pa.—1,737,259.

Centrifuge. William Burton Westcott, Wellesley, Mass., assignor to American Protein Corporation, Boston, Mass.—1,737,287.

Hammer Mill. John Gilmore Wilson, Paoli, Pa.—1,737,444.

Lining of Iron and Steel Pipes, Tubes, and Other Hollow Bodies. Charles Gurney Atha, Biggar, Scotland, assignor to Stewarts & Lloyds, Ltd., Glasgow, Scotland.—1,737,446.

Dehydrator. Frank C. Chapman, Modesto, Calif., assignor to Chapman Dehydrator Company, Modesto, Calif.—1,737,533.

Kiln. Harry M. Robertson, Cleveland, Ohio.—1,737,540.

NEWS *of the Industry*

Petroleum Industry Meets At Chicago

PREVAILING interest at the tenth annual general meeting of the American Petroleum Institute, held in Chicago from Dec. 2 to 5, was again accorded to the problem of conservation and overproduction, but in the technical sessions the predominant note struck was corrosion, which is said to cost the industry some $120,000,000 annually. Numerous other sessions marked each day and began, in fact, a few days before the main convention.

Following President Reeser's opening address, which reviewed the Institute's activities and pointed out the need for further agreement within the industry, Walter R. Teagle, president of the Standard Oil Co. (N. J.), presented a report of his appearance before the conference called by President Hoover on business stabilization. Of most spectacular interest was the brief appearance from Europe of Sir Henri Deterding, chairman of the Royal Dutch Shell group and most powerful foreign figure in the field. Sir Henri spoke for a half hour on the subject of "Common Sense in the Oil Industry," which represented a strenuous plea for agreement on world-wide distribution and for a concentration on quality rather than unnecessary quantity of production. The remarks were carried from the meeting without definite action, for it was felt that Sir Henri's Shell concern had pointedly nullified his preachment by its recent active invasion of all United States markets.

Among the papers of lively chemical engineering interest, mention should be made of the following: "Thermodynamics in Chemical Reactions of Petroleum Products," A. W. Francis and R. V. Kleinschmidt; "Stabilization by Chemical Inhibitors," Gustav Egloff, W. F. Faragher, and J. C. Morrell; "Studies in Distillation: Rectification of Heavy Naphtha," W. K. Lewis and E. R. Smoley. Developments in cracking were represented in three papers by Luis de Florez, R. C. Osterstrom and C. R. Wagner, and A. L. Strout. Corrosion of pipe lines and handling equipment was the subject of papers by Stanley Gill, Gordon N. Stout, K. H. Logan—Walter Rogers—J. F. Putnam, and Charles Fitzgerald; and corrosion in refining equipment, of papers by W. G. Whitman—J. K. Roberts, E. Retaillian—F. R. Lang and R. L. Duff.

While E. B. Reeser, president of the Barnsdall Corporation, was re-elected to lead the Institute, new vice-presidents were chosen as follows to head three newly-formed divisions: Production, L. P. St. Clair; Refining, W. N. Irish; and Marketing, W. N. Davis. Although Edward L. Doheny and Col. Robert W. Stewart were not re-elected to their former posts, Harry F. Sinclair returned to his place on the board of councilors.

Standard-I. G. Company Will License Patents

OUT OF its arrangement with the I. G. Farbenindustrie A. G.—Germany for participation in patents on hydrogenation, the Standard Oil Company of New Jersey becomes leader of a new Standard-I. G. Company, formed for the development of the mutual patent interests. The American company will have control and responsibility for management, as indicated in the officers recently chosen: F. A. Howard, head of Standard Oil Development Company, president; E. M. Clark, vice-president; M. H. Eames, secretary; R. P. Resor, treasurer; and as additional directors, Walter Duisberg, R. T. Haslam, Peter Hurll, H. A. Riedemann, H. G. Seidel, S. A. Shaw, Otto von Schrenk, and Guy Wellman.

With the experience gained at the partly completed plants at Bayway, N. J.; Baton Rouge, La., and Baytown, Texas, and the I. G. plant at Merseburg, it is hoped to make the process accessible by license over a large territory and to exert a fresh constructive influence on the petroleum industry as a whole by this new technical achievement.

Large Expansion Program For duPont

Plans of E. I. duPont de Nemours & Company, Wilmington, Del., call for the spending of more than $25,000,000 on building projects in the next twelve months. Of this amount, $16,000,000 will go to complete projects already under way, including rayon plants in the South, a cellophane plant at Old Hickory, Tenn., a plant for the Viscoloid Company at Leominster, Mass., and expansions at Belle, W. Va., for the duPont Ammonia Corporation.

Construction under way at the dye works at Deepwater, N. J., will involve a further expenditure of about $2,500,000 and $4,000,000 is to be spent for expansion and improvement of Grasselli Chemical Company plants throughout the country, with the largest expenditure, $1,500,000, at Grasselli, N. J.

White Re-Elected President Of A.I.Ch.E.

MANY important matters of business and policy were discussed at the annual meeting of the American Institute of Chemical Engineers, held at Asheville, N. C., Dec. 2-4, but except for the reception of committee reports and the election of officers, little definite action was taken. H. E. Howe, reporting the Institute's participation in the affairs of the American Engineering Council, showed the wide range of matters of public interest that come before that body. Despite the overwhelming majority in the membership's recent vote on the discontinuance of the transactions and of preprints, there is still some division of opinion. A number of those present felt that these and other questions might better be solved after the Institute has placed its business affairs in the hands of a permanent business manager or executive secretary. Many of these matters will have to come before the council prior to the next meeting in Detroit, which is scheduled for June 4, 5 and 6, 1930. R. A. Plum is to be the general chairman of this meeting, while Prof. W. L. Badger will be in charge of the technical program, which will largely feature the salt and heavy-chemical industries. Prof. C. S. Williamson, of Tulane University, presented an attractive invitation to hold the November, 1930, meeting in New Orleans. This was favorably acted upon.

Canvass of the ballots of the membership for the election of officers revealed the following selections: A. H. White, president; J. C. Olsen, vice-president; H. C. Parmelee, secretary; M. H. Ittner, treasurer, and David Wesson, auditor. New directors elected to the council included Fred C. Zeisberg, Arthur A. Backhaus, C. J. Esselen, Jr., and Prof. W. K. Lewis.

Expansion of Swann Companies

Theodore Swann, president of the Swann Corporation, of Birmingham, announces an increase in the total authorized number of shares of the corporation from 120,000 to 2,100,000, of which 100,000 may be preferred. This concern is incorporated under the laws of Delaware and companies included in the Swann group are the Southern Manganese Corporation and the Federal Phosphorus Company. Plants of the Swann Corporation are located at Birmingham, Anniston, Ala.; Hoopeston, Ill., and St. Louis, Mo.

Industrial Leaders Hold Conference At Washington

President Hoover Outlines Value of Construction and Maintenance Work

A GIGANTIC stride toward "systematically spreading into industry as a whole the measures which have been taken by some of our leading industries to counteract the effect of the recent panic in the stock market," as the President phrased it, was taken at the conference of industry held in Washington Dec. 5. Never before in America's industrial history has such a complete cross-section of the nation's business gathered for conference.

In his address President Hoover did not attempt to hide the fact that there is unemployment and that there has been reduction in the demand for certain types of goods, but his plea was to squeeze the emotion out of the situation, because emotions, "if they had been allowed to run their course, would, by feeding on themselves, create difficulties."

He pointed to the Federal Reserve System as the first line of defense. It had been powerfully effective. The next maneuver to prevent any advance of lack of confidence was to secure pledges from the leading employers that there would be no movement to reduce wages and to obtain corresponding assurances from labor leaders that they would co-operate to prevent labor conflict. With those objectives gained there would be continuity of consuming power, and fear would be removed from millions of homes.

THE purpose of the conference, the President pointed out, was to organize a counter-offensive in the form of construction and maintenance work to take up any slack in employment which may arise. He called attention to the fact that business men and economists are agreed that the acceleration of these activities in time of need makes a great balance wheel of stability. He made the statement without qualification that temporary speeding up to absorb idle labor brings great subsequent benefits and no liabilities. He emphasized the fact that nearly one-fourth of American wage earners are employed directly and indirectly in construction and in the industries engaged in the preparation and transportation of its raw materials. Another point made by the President, to which significance is attached, is his assertion that there is no advocacy of production of consumable goods beyond the daily demand. That, he said, only would stir up future difficulty.

No more important point, in the opinion of those assembled, was made by the President than that with reference to export trade. "We gain in prosperity by a prosperous world, not by displacing others," he said. By concentrating on development work such as the construction of highways and the establishment of utilities, the standards of living are raised and shortly there grows up an increased demand for goods. This thought was expanded by Dr. Julius Klein, Assistant Secretary of Commerce, in the course of his address, when he said:

"Above all things, our export effort should not be casual or take on the remotest semblance to a dumping campaign. Nearly every desirable market abroad is well protected against such procedure by legislation which would immediately be brought to bear and would discredit not only the individual traders involved but all American export in the given region.

"One of the major elements of strength in our economic position is the fourteen or more billions of dollars which our citizens have invested abroad. Just as England laid the foundations of her far-flung export activities by huge foreign investments, so we today can assure the maintenance and further development of our foreign trade through the legitimate, constructive acceleration of these holdings. Many of our investments in foreign public utilities and industries are reflected in our exports of material and equipment. The indirect effect in building up exports is even greater."

THE popularity of the President with the delegates was manifested by the prolonged applause when he appeared on the platform. The enthusiasm displayed partook of the political convention rather than a meeting of business men.

Dr. Klein also scored a personal triumph. His speech was one of the features of the day. He got off to a flying start by stating, after having listened to organization formalities, that the steam-roller industry has not been impaired in the slightest. It now is time for business men to get out of the huddle and carry the ball, he said. He told how the field of business had been illuminated and that the chance of panic under present conditions is immeasurably less than in the old days of obscurity and uncertainty. The universal penetration of the radio makes it possible for the nation to have a play-by-play report in such a situation. He called attention to the host of new facilities which dispel the dark shadows where malevolent growths of doubt, of suspicion, and of fear previously have thrived. The air mail, he declared, makes statistics available in the farthest corners of the land while they are still timely. Telephone mileage jumped from 11,600,000 to 62,200,000 last year. All of these provide a fine nervous system for business. Business is infinitely closer knit than at any other time of emergency in history. In this union there is strength. Enlightened collaboration is and indispensable element in economic stability.

CONTINUING, Dr. Klein emphasized the improved quality and increased influence of the business press. "Today the keen acumen of trade editors and their expert staffs, he asserted, has made the sequestration of any important economic facts difficult, if not impossible." He told how tens of thousands of miles of concrete highways are vibrating with fleets of buses and trucks, railways by reason of engineering improvements and other great developments had promoted a highly effective commercial liaison throughout the land. He stressed the need for checking distribution wastes and warned against any emotional extreme of hoarding or extravagance.

"There are at the moment," Secretary Lamont said in his talk to the conference, "more equipment orders on hand and in prospect than at any time in the past several years. These orders will help materially the steel, locomotive, car building and allied industries. The important thing is to keep up employment and wages, which spell buying power. Not many years ago at the first sign of slackening business the immediate thought was to lay off men and to cut wages. I have heard of but one instance in these recent weeks in which such action was proposed. Even in that case the notices which had been posted in the plants were withdrawn after one of the recent White House conferences." Then came this significant statement from the Secretary of Commerce: "We have learned that, when necessary, it is better to reduce hours than wage rates. If worse comes to worst it is advisable to alternate men by the week, giving some income to as many as possible."

THE chairman of the board of the U. S. Chamber of Commerce, Julius H. Barnes, saw in the conference an epoch-making event in the evolution of modern industry. Public confidence is industry's greatest asset, he said—an asset attained in recent years by the development of established ethics and standards and in the formulation of fair business practices. He told those in the assemblage that there is a very encouraging side to the industrial picture. A revival of the shipbuilding industry is under way. Oil has set its house in order. Agriculture is being restored to a fair relationship with other industry. Current commercial news records unexampled instances of extra dividends, as well as an unprecedented number of initial dividends.

Views on conditions in various industries, prospects for the coming year, and outlines of expansion programs as expressed by trade leaders will be found on page 772 of this issue.

NEWS FROM WASHINGTON

By Paul Wooton

Washington Correspondent of Chem. & Met.

CHEMICAL and allied industries are among those that will suffer least from the business disturbance, in the opinion of those who are following up the President's economic conferences. Generally speaking, 1930 is expected to be as good a year as 1929. Much more apprehension is expressed over the possible blighting influence of tariff legislation, or uncertainty if legislation is delayed, than from the business depression.

In so far as fertilizers are concerned, the improved agricultural outlook gives rise to the expectation of a better year in 1930 than 1929. In that branch of the industry, as well as in those more obviously affected, the tariff will play a part. If the duty is kept on ammonium sulphate, the new fixed nitrogen industry will be stimulated. The good beginning made in 1930, under such conditions, is expected to be improved upon as 1930 advances.

Drugs sell about as well in hard times as when general business is prosperous. The trade is toilet articles is growing so rapidly that even were the more pessimistic estimates to materialize the worst that could happen would be curtailment of the increase. Apparently, however, toilet goods is one of the last of the so-called luxury lines to feel the influence of decreased buying power.

LESS paint may be sold to automobile manufacturers in 1930, but a part of that loss will be offset by the demand for paint to restore old cars. A considerable percentage of automobile owners is expected to forego the luxury of a new car but many of them will repaint the old car, which will be continued in service. Increased building construction of certain types likely to result from the President's stimulation program, probably will augment the demand for paint, so that the total for 1930 well may exceed that for this year.

Demand for naval stores is expected to continue at about the same rate if high duties on oils are not levied. One-third of the domestic market of the rosin producers is furnished by the yellow soap industry. If a duty is levied on palm oil from Africa, the effect would be, according to statements made to the congressional committees, to eliminate most of the yellow soap, as white soap could be made cheaper under those conditions. It is admitted that there is no prospect whatever of securing a duty agains coconut oil from the Philippines. Waterproof varnish provides a market for another one-third of the domestic sale of rosin. A duty on tung oil could easily influence manufacturers to change over to lacquers, with the naval stores industry the chief sufferer. Rosin also is used to important amounts in lubricating grease made from low-grade imported oils and fats. A small duty would make it impossible for that grease to compete with petroleum products. The proposed duty of 5c. on castor oil probably would put sticky fly-paper, in the making of which much rosin is used, out of the running in competition with poisonous fly-paper.

Increased public works programs, including accelerated construction of highways, is expected to result in a larger demand for explosives.

WHILE Dr. Klein's plea, made at the Chamber of Commerce conference, for no abatement of research work meets with general approval, the opinion is expressed that there is less danger of such a decline than is generally supposed. There have been so many examples where products have been given great pre-eminence through the application of the results of laboratory studies that the essentiality of maintaining this branch of industry in full vigor is recognized almost universally. The federal government is setting an example in that connection. The administration is operating on a policy of increasing expenditures for activities of a research or reproductive character, but is continuing Coolidge economies with respect to agencies that are purely administrative or regulatory. So that these types of activities may be visualized, work is now in progress on a functionalized budget which will show at a glance the amounts spent for various activities, one of which will be chemical research.

EXPENDITURES by the United States government in chemical activities, as revealed by the budget, will be appreciably larger during the fiscal year ending June 30, 1931, than in 1930. The amount requested of Congress for the Bureau of Chemistry and Soils of the Department of Agriculture alone has been raised from $1,655,075 to $1,824,140. An analysis of the budget shows that the appropriation would be spent for the following items:

	Fiscal Year Ending June 30, 1931	Fiscal Year Ending June 30, 1930
Salaries and expenses	$58,540	$58,54
Agricultural chemical investigations	340,000	286,570
Color investigations (of raw materials grown or produced in the United States)	88,000	78,000
Sirup and sugar investigations	37,600	37,600
Insecticide and fungicide investigations	100,000	83,765
Plant dust explosions and farm fires	51,500	51,500
Naval-stores investigations	32,000	32,000
Soil chemical investigations	40,000	36,100
Soil physical investigations	18,100	18,100
Fertilizer investigations	345,000	311,500
Soil survey	310,000	274,000
Soil-erosion investigations	160,000	160,000
Soil-bacteriology investigations	43,400	43,400
Soil-fertility	200,000	159,000

Of the appropriation for the work of the Food, Drug, and Insecticide Administration, whose name it is proposed to change to "Food and Drug Administration," inasmuch as the word "drug" covers insecticides, the following sums are allocated for chemical projects:

	1931	1930
Chemical apparatus, chemicals and supplies, and salaries	$104,000	$104,000
Enforcement of the food and drugs act	1,105,000	1,030,000
Enforcement of the insecticide act	224,000	224,000
Enforcement of the Caustic Poison Act	26,700	26,700
	$1,459,700	$1,384,700

The total appropriation asked for the Administration is $1,596,000, as compared with the appropriation of $1,537,-300 granted for 1930.

IN addition to the chemical work conducted by the Bureau of Chemistry and Soils, and the Food, Drug, and Insecticide Administration, a variety of chemical activity is carried on by the other divisions of the Department of Agriculture.

The estimate for the Chemical Warfare Service shows a slight increase, going from $1,246,776 in 1930 to $1,295,-215 for 1931.

Department of Commerce chemical activities are concentrated mainly in the Bureau of Standards, Bureau of Mines, and the chemical division of the Bureau of Foreign and Domestic Commerce.

Estimated appropriation for the Bureau of Mines includes the following items of interest both to chemists and metallurgists:

	1931	1930
Investigating mine accidents	$438,640	$422,000
Mining investigations in Alaska	11,160	11,160
Operating mine-rescue cars and stations	330,530	326,130
Testing mineral fuels	179,210	179,210
Mineral mining investigations	165,000	144,220
Oil, gas, and oil-shale investigations	232,000	232,000
Mining experiment stations	230,450	230,450
Helium production, and investigation of resources of helium-bearing gas and the conservation thereof	75,000	75,000
Helium plants	306,190	95,800
Investigating potash deposits	100,000	100,000
Economics of mineral industries	307,600	285,000

The total appropriation requested for the Bureau of Mines is $2,549,480, as compared to $2,274,670 for the present fiscal year.

A total of $2,750,671 is asked by the Bureau of Standards, as against $2,506,-746 for 1930. Its budget includes:

	1931	1930
Equipment, including laboratory apparatus	$163,000	$88,000
Testing structural materials, such as stone, clays, cement	320,000	268,150
Investigation of fire-resisting properties of building materials	30,000	30,000
Testing materials such as varnish materials, soap materials, inks and chemicals	46,400	46,400
Color standardization	15,800	15,800
Investigation of clay products	49,000	49,000
Investigation of optical and other types of glass	27,300	27,300
Sugar standardization	95,000	75,000
Metallurgical research	61,000	51,000
High-temperature investigations	10,200	10,200
Industrial research, in cooperation with industries, with a view to assisting in the permanent establishment of new American industries	225,000	204,000
Standardization of equipment	250,000	220,000
Standard materials, used in checking chemical analyses	10,600	10,600
Investigation of radioactive substances and X rays	31,500	31,500
Utilization of waste products from the land	52,700	52,700
Investigation of physical and chemical properties of dental materials	10,000	5,300

French Labor Insurance Laws Will Become Effective in February

Regarded as Unfavorable for Development of Home and Foreign Trade

From Our Paris Correspondent

IN SPITE of overwhelming taxation, the general situation and industrial status of the country remain good. The new Cabinet taking into account the extra revenues has decided to reduce them by 3½ billion francs, another 5 billion francs being disposed of for the improvement of roads, harbors, transports, agricultural and industrial implements, etc., an obvious proof of the Treasury's easiness.

A less optimistic view of the near future may be contemplated, however, as the new Labor Insurance Law will come into force on Feb. 1 and greatly perturb business and industrial circles. A 10 per cent tax was decided upon, 5 per cent of the employee's salary being levied on the employer and 5 per cent on the employee. This 10 per cent tax on all salaries will be gradually reached; employers and employees paying respectively at first 3 per cent, then 4 per cent and finally 5 per cent each. The tax levied on agricultural circles on the contrary will reach only 2 per cent of the employee's salary, the employer paying one-half. It should be remembered that France is an agricultural as well as an industrial country, but agricultural interests always predominate in the French Parliament.

THOUGH the French Labor Insurance Law will not have its full effect until 1960, this thirty years' delay will not prevent the French commercial and industrial circles from paying now, on the 10 per cent tax basis, from 8 to 10 billion francs yearly. Obviously the cost price of all home products will rise, and foreign competition will benefit by it. This will also be a heavy handicap for the export trade which has already lost certain markets owing to the stabilization of the franc. A clear instance of the above statement may be given by the following figures: During the first six months of 1929 the commercial balance of French exports was 6 billion francs lower than it was during the same period in 1928. French exports to Germany have gone down from 3 billion francs to 2 billion 400 million francs, to the British Empire they have gone down from 4 billion 150 million francs to 3 billion 775 million francs. On the contrary German imports into France have risen from 2 billion 175 million to 3 billion francs. This last figure seems to indicate that in spite of contrary rumors the Franco-German agreement drawn with such difficulty has not been so unfavorable to Germany. Another Franco-German agreement of great importance to be discussed and settled shortly is the Sarre's future. The Sarre district is one of Europe's most important coal and metallurgical producers and considering its size its buying capacities are enormous. French exports to the Sarre district are more important than French exports to Spain or Italy. In Spain the custom duties levied on foreign goods are so high that they are almost prohibitive, and if France takes part at the International Exhibition of Barcelona it is merely to be represented there with no expectation of an increase in transactions.

French imports to the United States may be stated as follows: In the chemical industry 6 per cent of the total American imports in that branch, in the soap and perfume industry 14 per cent, in the potash industry a little over 13 per cent. It may be said that if there is an appreciable sale of French luxury goods in the American market there is only a very small one for chemical products; moreover new and higher custom tariffs are now under discussion at Washington and there is every reason to believe that sales in the American market will not extend.

At a Vegetal Carbon Congress recently held in Lyons the use of vegetal carbon or charcoal as motory power was advocated. According to figures quoted by statisticians the home output of charcoal reaches at present 300,000 tons.

THE Pine Institute states that the best charcoal available is reddish charcoal made by torrefaction at 275° C. This process makes charcoal containing much more gas than ordinary charcoal, and it has far more caloric power. In practice, however, these theories cannot be applied as the high price of transport and collection of cheap and waste woods cut down profits to such a margin that it ceases to be a paying proposition. This carbonizing method is therefore only applied on a small scale. The Charcoal Congress also studied the wood alcohol question, a chemical engineer stating that up to 250 liters of wood alcohol could be extracted per ton of wood, the chemical agent used being hydrochloric acid. This process remains still a laboratory experiment. In Germany diluted sulphuric acid at 1 per cent is used instead of hydrochloric acid, 150 liters of wood alcohol being extracted per ton of wood. This process though not entirely satisfactory would allow the manufacture of 35,000 hectoliters per annum.

Finally the Charcoal Congress suggested the use of second quality wood tars for the tarring of roads as a substitute for coal-tar which must be imported. This suggestion was not unanimously approved, objectors stating that wood tars contain phenol which being washed away by rain would run to rivers and streams, pollute the waters and poison the fish. It was also pointed out that phenol is destructive to vegetation. The Charcoal Congress, therefore, voted that in future wood tars should be manufactured with a much smaller percentage of phenol.

Japan's Engineering Congress in Retrospect

By Kendall K. Hoyt
Corresponding for Chem. & Met. from Tokyo, Japan

UNIFORMLY favorable reports are coming back with the American delegates returning from the World Engineering Congress. The expectations which attracted such large numbers to Tokyo were well realized not only through the sessions, but in the post-conference tours which only recently came to an end. The Japanese spared no effort in outdoing even their own famed hospitality.

The value to American engineers will become more evident with the passing of time. That, as a whole, they gained little of technical value on the spot implies no criticism of the arrangements, which were of the best, but should be remembered as the continuance of an unfortunate trend in the large international gatherings. This time technical matters were thrust aside without regret, but under less favorable auspices the result might have been damaging.

Even had there been no technical program, the World Engineering Congress and the World Power Conference would have been well worth while to all concerned. As a step toward international understanding, the meeting has accomplished in one way what the Pacific Relations Conference, held at the same time in Kyoto, Japan, has done in another. Several hundred engineers turned loose in a country, with free railroad passes and every encouragement to observe, can not fail to disseminate through the profession a clearer picture of Oriental people, conditions, and practices. Interviews with the delegates here showed that to a man they are returning with a greater friendship and with a greater respect for the Japanese, individually and as a race.

Japanese chemical progress in a dozen lines has been evident in trade figures for some years past. Perhaps less knowledge concerning the Japanese chemical industries was gained during the conference than in any other line, as few of the plants were included in the trip schedules. Many chemical plants are, in fact, open to outsiders under almost no circumstances. The Japanese chemical engineers, however, contributed largely to the discussions of the chemical section by a number of papers on rather detailed matters.

New Developments in Processes and Equipment in Germany

Production of Sulphate of Ammonia Attracts Research Workers

From Our Berlin Correspondent

A NEW electric nitrogen process of Dr. Tern utilizes only the byproducts of gas works for making ammonium sulphate and makes the purchase of sulphuric acid unnecessary. Already in practical operation in several instances, the process gets its ammonia by carry-over with steam in the customary columns. The SO_2 comes from the waste gas-scrubbing material, which is roasted in ovens, and the resultant SO_2 converted in an electric arc. In an electro-filter the SO_3 is then precipitated with the ammonia as ammonium sulphate. The moisture of the gases is sufficient to provide the steam for the process and the salt, with a 20 per cent nitrogen content, is pure white and ready for use. The power consumption is so low that the savings in sulphuric acid should make it possible to write off the equipment in a short time. The Thüringer Gasgesellshaft, Leipzig, is building sizeable installations of this process, from 10 million cu.m. annual capacity upward, which have a total capacity of 37,000 tons of Electroammon, as the new fertilizer is called. The cost for 1,000 kg. of this product is supposed to be about 100 marks less than the normal byproduct cost.

Another process for obtaining ammonium sulphate is known as the CAS, of the firm of Heinrich Koppers, Essen. The sulphur of the coke-oven gas is directly converted into sulphate by treatment with ammonia, but the process also provides for the removal of cyanogen at the same time, giving the process its name: Cyanogen-Ammonia-Sulphur. The raw gas, freed of tar, is separated from the ammonia, which is concentrated to 8-12 per cent. In a suitable scrubber the gas is then freed of ammonia, cyanogen, and H_2S, the liquor being partly regenerated and partly treated with sulphurous acid for conversion to polythionate. The thionate liquor is split in autoclaves into ammonium sulphate and sulphur. The latter is removed hot, while the hot 50 per cent sulphate is evaporated and finally dried in centrifuges. This process, too, is said to promise well economically because it dispenses with sulphuric acid.

A NEW heating system for chemical apparatus has been developed mutually by Samesreuther & Co., Butzbach, Hessen, and the I. G. Farbenindustrie. The walls of a kettle are supplied with coils, copper strips being inserted between them, and the coils welded to the wall. It is necessary to weld only moderately with electric current, so that the outer rolled surfaces are but slightly attacked and the structural qualities are not impaired. During welding the kettle becomes only negligibly heated, while the heat transfer afterwards is very satisfactory. An advantage of this type of construction is that the kettle wall must be designed to withstand the normal internal pressure, but not the pressure of the heating medium. The cost of this type is relatively high where low pressures prevail, but becomes economical when pressures of 14 atm. are involved. The process can be applied to copper, V$_2$A, cast iron, Silumin, as well as to forged iron; with certain modifications it may also be used with enameled apparatus. Another application of this principle is in the form of plane surfaces and hot plates, e.g. for vacuum driers, where it permits considerable savings.

THE corrosive action of fatty acids on metals, especially copper and aluminum, was the subject of an important investigation of Dr. Lederer, Hamburg. The standard of measurement is the loss in weight per hour for 1 sq.m. of surface, at a specified temperature of acid and a definite rate of motion of the acid toward the metal. It was found that copper and aluminum tested under working conditions, that is, in a cracking autoclave under 12 atm. pressure, during 128 charges (1,024 hr.) at 188 deg. C., lost 0.009 gr. per sq.m. per hour for copper and 0.042 for aluminum. In the autoclaves, technical grade peanut oil was treated in the presence of zinc and zinc oxide and perhaps the aluminum proved more corrosible because basic zinc hydroxide was present. The corrosion of nickel by technical stearic acid was studied at 190 deg. The nickel sheet, with a total surface of 80 sq.cm. remained for 2 hr. in hot, but undisturbed, stearic acid; when interpolated the corrosion was found to be 0.62 gr. per sq.m. per hour. From these figures it is evident that a copper autoclave (total surface about 16 sq.m.) will lose about 1.5 gr. to the 2,500 kg. of fatty acid, which represents only about 0.0004 per cent.

The selective extraction of oil mixtures has been found to be facilitated by the use of methyl formate, which can be easily separated again due to its low boiling point. Methyl formate can be readily prepared from methyl alcohol and carbon monoxide. A sesame oil, when treated 3 times with 3 times its quantity of methyl formate had its 10 per cent acid content reduced to 0.2 per cent. A fraction of raw Mexican oil, shaken with methyl formate in an equal ratio, displayed a sulphur percentage of only 0.6 instead of the original 2.3.

AT THE dedication of the new lecture hall of the Kohlenforschungsinstitut Mühlheim (Coal Research Institute of Mühlheim), Walter Fuchs spoke of carbon as an object of organo-chemical research. Declaring that "nothing is more practical than theory," he went on to describe how he has successfully probed into the still mystifying constitution of pure carbon, by oxidation of humic acid. Using dilute nitric acid, very mildly warmed, for a brief period, an oxidation product was obtained which, although not strikingly different from the original substance, was soluble in organic solvents, in contrast to humic acid. Fuchs believes that, although liquefaction of coal is at present of primary interest, the oxidation may have a wide commercial future.

It is of incidental interest to observe that the *Chemisches Zentralblatt*, one of the oldest technical publications, has just celebrated its 100th anniversary which received recognition at a dinner in Berlin.

Chemicals Represented at Barcelona Exposition

REPORTS from trade commissioner at Barcelona, Spain, state that the chemical industry is well represented in the Barcelona Exposition, as it had not only one building, the Palace of Chemical Industry, to itself, but several small pavilions in which are housed the exhibits of local companies.

La Sociedad Anonima Cros, which ranks at the head of the Spanish chemical industry, with a capitalization of 30,000,000 pesetas, constructed a good sized pavilion in which it is exhibiting various acids, fertilizers, super-phosphates, sodium sulphide, sulphates of iron, copper, zinc, aluminum, and soda, carbon bisulphide, and hyposulphite and bisulphite of soda. In the same building other Spanish companies are exhibiting liquid chlorine and its derivatives.

The French chemical industry occupies a large section of the Palace of Chemical Industry, where many exhibitors and manufacturers of similar products are grouped.

The German chemical industry occupies one end of the Palace of Metallurgy. Among these are the I. G., which occupies more than half the section, showing products of Agfa, Meister Lucius & Brunning, and Bayer & Company. Others are Casa E. Merk, Wolff & Company, Leo Werke, H. E. Albert, P. O.-H. O. Sanitas Werk, and Schering-Kahlbaum.

The exhibits of Italian producers occupy a small space in the Palace of Chemical Industry, including chiefly organic and pharmaceutical products.

The Swiss section occupies only a small section, to the rear of the Palace; the principal exhibitors are Dr. A. Wander, S. A.: S. A. Le Lisodis; Merx y Biutelli; Cristallo, S. A., and Apotela, S. A..

News in Brief

A REPORT from Toronto, Canada, states that Hiram Walker-Gooderham & Worts, Ltd., has announced that the first unit in a plant for manufacture of carbon dioxide will be started early in 1930, and that additional units in Montreal and other large Canadian centers will be built shortly. Carbon dioxide is a byproduct of the distilleries. A new subsidiary will be formed, which also will manufacture dry ice, a solidified form of carbon dioxide.

EXPANSION OF OPERATIONS of Procter & Gamble Company on the Pacific Coast will involve the construction at Long Beach, Calif., of a complete manufacturing unit to cost $5,000,000. The new unit, which will go into construction as soon as possible, will be the largest soap factory in the West. The new unit will manufacture all of the company's lines of soaps and edible oils.

DISCOVERY OF CHROMITE has been made in northwestern Ontario by the Consolidated Chromium Corporation, a company recently formed by Golden Center Mines, Inc., and Charles V. Bob & Company. The deposit is close to the main line of the Canadian National Railways about 30 miles west of Lake Napigon.

AN AGREEMENT is reported between E. I. duPont de Nemours & Company and the Oberkoks Chemical Company, Berlin, Germany, granting the latter the right to manufacture "Duco" at the Oscar Mosebach factory, Riesa, Saxony. The Saxony firm is a subsidiary of the Oberkoks company. In return for the exclusive right to manufacture "Duco" in its territory the Oberkoks company will pay the duPont company partly in cash and partly in stock in a new company which will hold the patent rights.

THE ANNUAL CHRISTMAS PARTY of the Salesmen's Association of the American Chemical Industry will be held Friday evening, Dec. 27, at the McAlpin Hotel, New York. This affair has been a yearly feature of the association's activities and the coming party promises to at least equal, if not exceed, previous Christmas week celebrations. The dinner will be featured, as usual, by the distribution of the *Chemical Peddler*, the organization's official publication, issued once a year.

THE NEW POTASSIUM NITRATE PROCESS operated by the Wintershall concern at its plant at Sondershausen, Germany, utilizing its Claude synthesis ammonia from its Rauxel plant is producing nearly 100 tons of potassium nitrate daily. It also gets a byproduct yield of ammonium chloride, a fertilizer. The process now used treats potassium chloride from Sondershausen mines with nitric acid for a yield of potassium nitrate and hydrochloric acid. The acid is then treated with ammonia, yielding ammonium chloride which is concentrated and crystallized. The Sondershausen plant is being expanded and next year will begin production of potassium nitrate and ammonium phosphate by treating phosphate rock with nitric acid and potassium sulphate.

THE CERAMIC DEPARTMENT at the University of Illinois announces three short courses in ceramics, which will be held during January. Unlike the former short courses given at this institution, the material is divided into three groups. One set of lectures, devoted entirely to the subjects of interest to the heavy clay products man, will be given Jan. 20 to 25. A second set of lectures will be given Jan. 27 to 31, for the man interested primarily in the industries using ceramic bodies and glazes. The third set of lectures, Jan. 27 to 31, will be given for the man interested in vitreous enamels.

THE SHELL DEVELOPMENT COMPANY, subsidiary of the Shell Oil Company, has purchased 135 acres near Long Beach, Calif., for the nucleus of a $5,000,000 nitrogen fixation plant. The Shell company has purchased the American rights to German patents covering a process which will extract nitrogen from the air for agricultural fertilizer and industrial chemical purposes. The plant will be electrically operated. Construction is expected to start shortly on the first unit, which will cost $250,000. Additional units will follow as fast as conditions warrant.

Rheologists Will Convene In Washington

A MEETING of the newly organized Society of Rheology, devoted to the flow of matter, will be held at U. S. Bureau of Standards, Washington, D. C. on Dec. 19 and 20. There will be afternoon and evening sessions on Thursday, and a morning session on Friday, which will be devoted to numerous papers already arranged for. The afternoon of the second day will be devoted to an inspection trip, arranged especially for the rheologists in attendance. The Bureau of Standards has much equipment of special interest to those attending. There is not only the equipment for the exact measurement of length, temperature, time and pressure, but apparatus for measuring the consistency of lubricants, paint, lime, metals, alloys, etc.

Headquarters of the society will be the Washington Hotel. Meetings will be held in the auditorium of the East Building. Winslow S. Herschel of the Bureau of Standards is chairman of the local committee. Programs of the meetings may be obtained from A. Stuart Hunter, duPont Rayon Company, Buffalo, N. Y.

Carbon Black Trade Forms Export Association

REPRESENTATIVES of companies producing more than 92 per cent of the world output of carbon black have formed the Carbon Black Export Association, Inc., a Delaware corporation organized under the Webb-Pomerene law, to promote the rapidly growing interests of American carbon black manufacturers in foreign markets.

Participating in the formation of the export association were Binney & Smith Company, representing Columbian Carbon Company, Coltexo Corporation, Keystone Carbon Co. and Texas-Louisiana Carbon Black Co.; United Carbon Company, including its subsidiaries, Kosmos Carbon Co., Eastern Carbon Black Co. and Crystal Carbon Co.; Godfrey L. Cabot, Inc., including Texas Elf Carbon Co., Cabot Co., Cabot Carbon Co., and Gas Products Co.; J. M. Huber, Inc., including J. M. Huber Co. of Louisiana, Inc., Ebony Carbon Co., Weston Carbon Co. and J. M. Huber Pigment Co.; the Palmer Gas Products Corporation, representing the associated carbon black interests of the Palmer Corporation and Electric Bond & Share Company; and R. W. Greeff & Co., Inc., representing Texas Carbon Industries.

The officers of the association will be Norman Lee Smith of Binney & Smith Company, president; Edmund Billings of Godfrey L. Cabot, Inc., vice-president; R. H. de Greeff of R. W. Greeff & Co., secretary; G. A. Williams of United Carbon Company, treasurer; H. W. Huber of J. M. Huber Co., assistant treasurer. They, together with John W. Herron of Palmer Gas Products Corporation, will constitute the board of directors.

Amendments Suggested for Naval Stores Act

SUGGESTED amendments designed to clarify and to remedy certain defects in the Federal Naval Stores Act as originally enacted were considered at a conference held Nov. 25 at the Food, Drug, and Insecticide Administration of the U. S. Department of Agriculture. The meeting was attended by representatives of the producers and consumers of naval stores and members of the Department of Agriculture. Among the proposed amendments considered was a provision requiring definite branding of packages for sale or shipment with plain and conspicuous statements showing the true kind and grade of naval stores. This would not apply to bulk shipments or to shipments moving from the place of production to a grading point. Another provision would make it a violation of the act to tamper in any way with federal inspectors' grade marks on packages or with the certificates issued by federal inspectors. Imported naval stores would also be placed under the same restrictions.

MEN *in Chemical Engineering*

IRVING LANGMUIR was chosen to receive the Chandler Medal for 1929, awarded by Columbia University for achievement in chemical science. He received the medal on Dec. 13 at a distinguished gathering, before whom he gave the annual lecture on the subject of "Electrochemical Interreactions of Tungsten, Thorium, Caesium, and Oxygen." Dr. Langmuir is president of the American Chemical Society and associate director of research for the General Electric Company.

DONALD A. KOHR, president of Lowe Brothers Company, Dayton, Ohio, has been elected a director of Sherwin-Williams Company, which absorbed the former early this year.

CHARLES E. NELSON, who was formerly engaged in chemical development at the Chevrolet and Dodge Brothers plants, has joined the duPont Ammonia Corporation at its experimental station in Wilmington, Del.

R. N. SHAFFER has left the Great Western Sugar Company in order to undertake chemical engineering work on design and operation for the Dorr Company.

T. E. DOREMUS, Seattle, Wash., has been promoted to vice-president of the Grasselli Chemical Company from the duPont Company, for whom he was Pacific Coast manager.

DON G. MITCHELL, who was director of the industrial site division of the McGraw-Hill Publishing Company, has accepted a similar post with the Niagara Hudson Power Company.

ROBERT G. WULFF has opened a consulting practice in chemical engineering at Los Angeles, Calif., and will specialize in the study of the commercial applications of new processes.

THOMAS MORRIS is now working under the Cushman Research Fellowship at Western Reserve University on the fundamental reactions of vitreous enamels. Mr. Morris, a graduate of Brown University, was a chemical engineer for the Brown Company, Berlin, N. H.

GEORGE WALKER has returned to the Dorr Company's development department after an absence of seven years. Mr. Walker, who finished his technical schooling just before serving with the Ordnance department during the War, was engaged in work on alum for the Dorr Company from 1919 to 1922 and then became works manager of the North Hudson Chemical Company. On leaving this firm when absorbed by the duPont Company in 1927, he took up the organization of the Albany Air Service, where he was active until this year.

JOHN VAN NOSTRAND DORR, president of the Dorr Company and originator of many important unit process methods, was named for the award of the James Douglas Medal for 1929. The medal is bestowed by the A.I.M.E. annually for distinguished achievement in non-ferrous metallurgy. Dr. Dorr, who was a graduate of Rutgers in 1894, took part in one of the most productive periods of engineering in the West.

JOHN V. N. DORR

There he served as chemist and metallurgist and developed the classifier, thickener and other continuous apparatus that has come to play such a guiding part in modern technology. The medal will be officially bestowed at the annual banquet of the A.I.M.E. late next February.

L. KERMIT HERNDON has joined the State Water Commission of West Virginia as chemical engineer for research on stream pollution.

W. D. MAGINNES has been put in charge of all sales and promotion work of the duPont Viscoloid Company for the entire country.

NORMAN GIBSON MADGE has been made assistant general manager of the development department of the United States Rubber Company at Passaic, N. J., since his transfer from the Providence, R. I., plant.

G. L. GABRIEL, vice-president in charge of research and development for the Commercial Solvents Corporation, has transferred his headquarters from Terre Haute, Ind., to the New York office of his company.

E. B. NICHOLS has been appointed chief engineer of the Brown Instrument Company, Philadelphia. His technical experience includes positions at the Pfaudler Company and Victor Talking Machine Company as chief engineer, and at the Bell Telephone Laboratories.

CALENDAR

AMERICAN CHEMICAL SOCIETY, 79th meeting, Atlanta, Ga., April 7 to 11, 1930.

AMERICAN ELECTROCHEMICAL SOCIETY, spring meeting, St. Louis, May 29-31, 1930.

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, annual meeting, New York, Feb. 18-20, 1930.

OBITUARY

CHARLES W. BAKER, president of Baker & Company, Inc., Newark, N. J., died on Nov. 16 after a brief illness. Mr. Baker, who was born in that city in 1869, received his schooling there before entering the firm founded by his father and elder brother. He was active as vice-president in the company's growing position in the precious metal refining and fabrication field from 1904 to 1918, when, on his brother's death, he became president.

FRED NEHER, since 1891 connected with the chemistry department at Princeton University, died at his home there on Dec. 10 at the age of 62. Professor Neher was head of the department from 1903 to 1914, when he diverted his attention to chemical problems of the War and later worked on poison gas problems for the Chemical Warfare Service.

JEFFERSON D. ROBINSON, president of the Libbey Glass Manufacturing Company, died suddenly at Toledo, Ohio, on Nov. 8.

INDUSTRIAL NOTES

DURIRON COMPANY, Inc., announces enlargement of its plant in Dayton, Ohio, and plans for a foundry at Newark, N. J. Coincidentally it has become affiliated with the Industrial Welded Alloys, Inc., in sales and manufacturing.

NATIONAL ALUMINATE CORPORATION, Chicago, announces the availability of an industrial motion picture film illustrating the effects of proper coagulation on the behavior of boiler waters. The film was shown before the recent meeting of the American Institute of Chemical Engineers at Asheville, N. C.

FULLER COMPANY, Catasaqua, Pa., has bought the rights of the "Airveyor" handling equipment from the Guarantee Construction Company, New York.

MERCO NORDSTROM VALVE COMPANY has appointed C. E. Brown vice-president in charge of sales, C. C. Evernham purchasing agent stationed at San Francisco, and E. D. Rogers general sales manager, also at San Francisco.

LINCOLN PRODUCTS CORPORATION, 31 Fulton St., Newark, N. J., has been appointed distributor for the products of the Lewis-Shepard Company, Boston.

HOLLY PNEUMATIC SYSTEMS, Inc., New York, has appointed F. G. Dunbar & Son agents at 53 West Jackson Boulevard, Chicago.

FULLER LEHIGH COMPANY has opened a branch office at 703 Traction Building, Cincinnati, Ohio, under H. E. Martin.

HEADLEY EMULSIFIED PRODUCTS COMPANY, Marcus Hook, Pa., is the successor to Headley Good Roads Company and will expand its products to cover protective coatings. Officers are Edgar S. Ross, President; Parmely Herrick and M. W. Lefever, vice-presidents; G. D. Webster, secretary.

PHILFUELS COMPANY will henceforth conduct all its operations from its offices in the General Motors Building, Detroit.

WEISBURG & GREENWALD, consulting chemical engineers, have made Frank E. Richardson an associate to handle chromium plating sales.

ECONOMIC INFLUENCES
on production and consumption of CHEMICALS

Chemical Production Well Maintained In Recent Weeks

Seasonal Conditions Cause Moderate Slowing Up in Operations

MANUFACTURING activities in general are conceded to have been restricted during the last six weeks. Some of the basic industries for which reliable statistics are at hand demonstrate the accuracy of this statement. Production of chemicals has felt the influence of seasonal conditions and outputs have fallen below those of the more active periods of this year. The position of chemicals, however, has been more favorable than that of industry as a whole. Forward buying of chemicals has been of large proportions and this has enabled production to be maintained in an active way without bringing in the possibility of accumulating stocks.

Unsold stocks of chemicals at this time are not large and the trade will enter the new year with no carryover of unfavorable conditions except a probable reduction, in 1930, in certain consuming outlets. Such losses, however, promise to be more than offset by gains in other directions. Alkalis, chlorine, ammonia, phosphoric acid, mineral acids, and certain nitrogenous materials may be mentioned as examples of chemicals which are expected to move in larger volume in the coming year.

ACCORDING to figures based on consumption compiled by *Electrical World*, manufacturing operations in this country in November were about 11.7 per cent below those of the preceding month. On this authority the indexes of production showed the following:

	Oct. 1929	Nov. 1929	Nov. 1928
All Industry	134.6	122.9	133.3
Metals	145.1	126.9	143.5
Foods	131.7	127.9	130.0
Textiles	129.8	115.5	132.5
Automobiles	122.4	88.4	127.1
Chemicals	145	147.3	135.7
Forest Products	109.9	111.8	111.8

The above figures indicate that activity in the various groups specified not only declined from the levels of the preceding month but also were lower than for the corresponding period of last year. Chemical production offered an outstanding exception, as operations in November are shown to have been larger than those for October and considerably in excess of those for November, 1928. As electrical consumption is not inclusive enough to cover the entire chemical manufacturing industry, the comparison as given may be somewhat more optimistic than complete figures would justify. There is no doubt, nevertheless, that the output of chemicals has been large and that this industry in recent weeks has been relatively more active than manufacturing in general. It may also be stated that production and consumption of chemicals for the year will show a gain over the totals for 1928, with some variation in opinions regarding the degree of difference.

INDUSTRIAL output during October, after adjustments for seasonal variations, showed a decline from the previous month but was greater than a year ago, according to the weighted index of the Federal Reserve Board. The production of manufactures was lower than in September while the output of minerals showed no change; both manufactured commodities and minerals were produced in larger quantities than in October, 1928. As compared with a year ago, the output of manufactures was generally larger in all industries except iron and steel, foods, leather and shoes, automobiles, and rubber tires, where declines were noted.

Stocks of manufactured goods in the hands of manufacturers at the end of October showed no change from a year ago and were slightly lower than in the previous month. Stocks of raw materials, on the other hand, showed gains over both periods.

Italy Now Producing Synthetic Methanol

A report from Elizabeth Humes, trade commissioner in Rome, says it is estimated that the Casale process for the production of synthetic methanol has been perfected by the engineers of the company and is now being applied industrially at the plant of the "Siri" at Terni. The Ammonia Casale and the Societa Terni are jointly interested in this plant to the extent of 60 per cent and 40 per cent respectively. The "Siri" plant is now producing a ton and a half of synthetic methanol daily, which is as much as can be absorbed by the Italian market at the present time, but the plant has a capacity of six tons daily.

The general index of unfilled orders of manufactured goods showed a decline from the previous month but was greater than a year ago. Declines from the preceding month in unfilled orders for textiles and lumber more than offset gains in iron and steel and transportation equipment, principally railroad. Contrasted with last year gains in iron and steel and transportation equipment more than offset declines in textiles and lumber.

THE status of some branches of the chemical-producing and chemical-consuming industries in October in comparison with October, 1928, may be inferred by inspection of statistics which are available. The figures include the following:

Production

	October 1929	October 1928
Acetate of lime, 1,000 lb.	12,479	10,526
Methanol, crude, gal.	716,789	641,823
Methanol, ref., gal.	445,183	487,384
Alcohol, ethyl, 1,000 gal.	25,426	20,685
Alcohol, ethyl, withdrawn for denaturing, 1,000 gal.	24,203	20,718
Arsenic, crude, ton	3,113	1,622
Arsenic, refined, ton	1,036	802
Automobiles		
Passenger cars, no.	320,327	339,487
Trucks, no.	58,747	57,138
Taxicabs, no.	868	659
Coke, byproduct, 1,000 ton	4,610	4,219
Explosives, 1,000 lb.	42,108	38,636
Glass plate, 1,000 sq.ft.	14,621	11,140
Glass, containers, 1,000 gross	2,572	2,389
Petroleum refined, 1,000 bbl.	88,390	79,663
Rosin, wood, bbl.	40,903	36,942
Turpentine, wood, bbl.	7,585	6,486
Pine oil, gal.	259,017	219,525

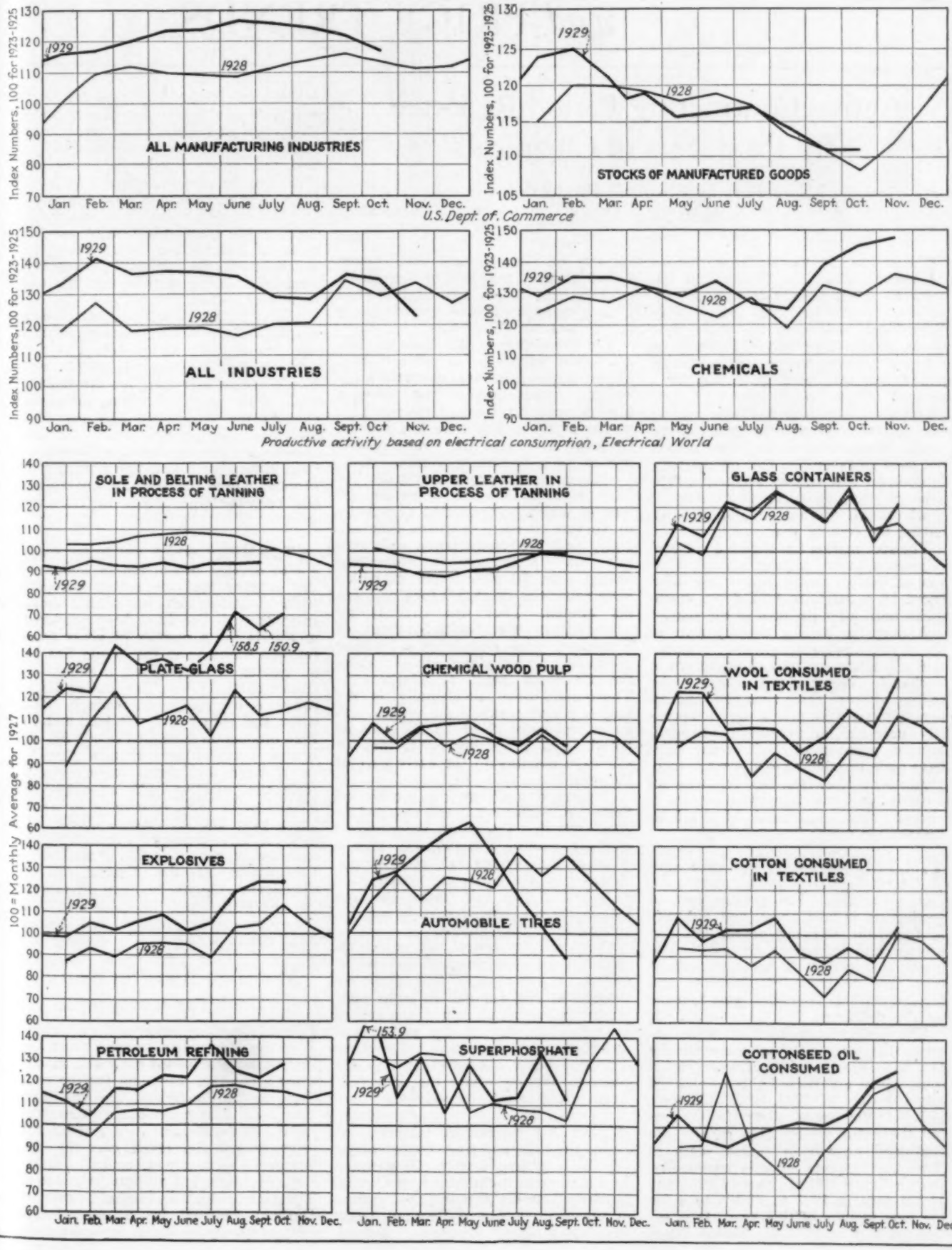
Consumption

Cotton, bales	640,798	616,238
Silk, bales	57,489	49,940
Wool, grease equivalent, 1,000 lb.	59,352	51,477
Cottonseed oil, bbl.	373,000	348,000

It will be seen that wood distillation chemicals were produced in larger volume in October, this year. Acetate of lime production for the ten months ended October ran more than 9,000,000 lb. above that for corresponding period of 1928, yet stocks at the end of October were reported at 1,679,704 lb., as against 2,862,516 lb. at the close of October, 1928. The output of crude methanol for the ten-month period showed a gain of more than 800,000 gal. and stocks at the end of October at producing plants were 251,704 gal. as against 314,171 gal. in the preceding year. Stocks at refineries, however, were larger this year.

In the consuming industries, the figures reveal appreciable increases in activity in the cotton, wool, and silk branches of the textile industry. Plate glass and glass containers also were produced in increased volume and the same is true for explosives. Petroleum refining has been running high throughout the year but recent developments point to a voluntary cutting down of refinery operations in order to work off surplus holdings of refined oil products.

ACTIVITY IN PRODUCING AND CONSUMING INDUSTRIES



MARKET CONDITIONS *and* PRICE TRENDS

Active Contracting Period Reported By Producers of Chemicals

Large Part of Chemical Production for 1930 Sold Ahead

TRADING activity in the market for chemicals in the last month has centered in the placing of contracts involving deliveries over next year. Immediately following the sharp drop in securities, there was a tendency on the part of consumers to adopt a waiting policy, but this soon gave way to a renewal of contract buying. In some chemicals contracting has been heavier than for the corresponding period of last year. In other cases the reports have not been so favorable, but, on the basis of contract holdings by producers, it is apparent that the chemical industry as a whole will operate on a large scale during the coming year.

The spot market has shown a seasonal relaxation, with buying described as spotted and evidently buyers are influenced by a desire to hold down inventories until after the turn of the year.

Among the trading developments of the month was a resumption of competitive selling on the part of producers of methanol. The market had been under selling pressure some time ago, and attempts to stabilize prices were temporarily successful, but irregularity has again become pronounced and recent sales have gone through at low levels.

Acetone, likewise, has followed an unsettled course with open reductions in quoted prices as a result of the keen competition which has developed.

LIMITED supplies of salt cake have resulted in a very firm market for that commodity. The greater part of production is sold ahead and difficulty is found in securing round lots for prompt and immediate shipment. Domestic production is not sufficient to take care of home requirements and foreign markets are called upon to make up the deficiency.

The Department of Commerce reports that imports of salt cake for the first nine months of 1929 were 75,426 tons, which approaches three times the total imports of 1928, of 28,228 tons, and is at the rate of about 100,000 tons for the entire year. This reflects the continued growth in recent years in American imports of this commodity, from a figure of 1,913 tons in 1925 and 11,171 tons in 1927 to 75,426 tons for the nine months of this year. It is estimated that in 1927 the United States imports of German salt cake represented about 8 per cent of Germany's total exports, 20 per cent in 1928, and present figures indicate approximately 45 per cent for 1929.

The production of salt cake in Germany was introduced to utilize a part of the large quantities of waste magnesium sulphate which had formerly been dumped into German rivers. This source of cheap salt cake has enabled Germany to sell to the United States market despite transportation costs. Preliminary estimates of production for 1928 were 280,000 tons, some 100,000 tons of which are exported principally to Norway, Sweden, Denmark, Belgium, Italy, and the Netherlands. German salt cake production is distributed among some 70 plants, four of which have capacities of 18,000 tons or more per annum. They are virtually all combined in the Sulfat-Syndikat of Frankfort, with powers of allocating production, fixing prices, etc. Of these the Kaiseroda plant at Merkers in Thuringia, which incidentally is the largest potash plant in the world, with an annual capacity of 120,000 tons of potash, was producing 8,000 tons of salt cake monthly in the early part of the year.

Imports of salt cake into the United States in September were reported at 20,605,699 lb. The value, according to consular invoices, was $99,143. This is about at the average rate of $9.60 per short ton if the goods are priced on a c.i.f. basis. Salt cake is on the free list, hence the landed cost is not increased by a duty impost.

Quiet call for benzol last month resulted in the appearance of competitive selling. It was reported that sales went through at 20c. per gal. in tanks f.o.b. producing points. A firmer tone existed in the latter part of the period and underlying conditions are said to have improved because production was cut down to a point where the danger of large unsold stocks was averted.

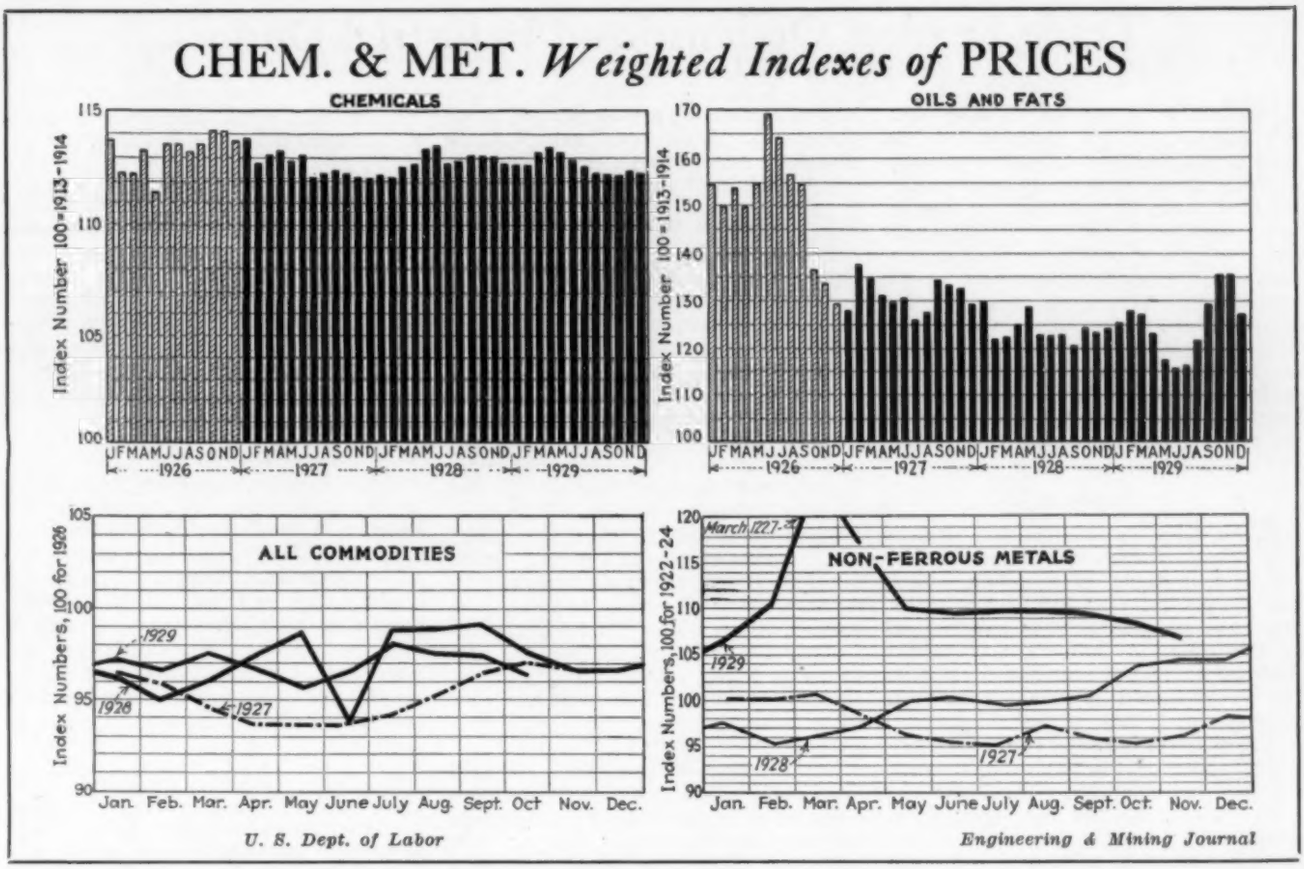
Reports from assistant commercial attaches D. J. Reagan, Paris, and L. W. Hunt, Brussels, and trade commissioner W. T. Daugherty, Berlin, call attention to the agreement concluded on Oct. 26 in Paris between the principal groups of benzol producers of Belgium, Great Britain, France, Germany, Ireland, Luxemburg, Netherlands, and the Star. The problem of the producers is to bring production and distribution into closer harmony. Semi-annual meetings will be held, the first in London in December, 1929, and the next in Germany in June, 1930. The permanent office of the cartel will be located in Paris. The aim of the cartel is the standardization of various types of benzol, the improvement of motor benzol, the application of appropriate distributive methods and the extension of its use.

The National Fertilizer Association reports that for November fertilizer tag sales for fourteen states were 28.1 per cent less than for November, 1928, and 30.4 per cent less than for November, 1927. Even in the preceding month of October tag sales were 31.4 per cent less than for October, 1928. Almost two-thirds of the decrease for November from November a year ago occurred in Florida, where the fruit fly quarantine has been a large factor in reducing sales.

ATTEMPTS which are being made to develop production of iodine in this country lend interest to a report from abroad which states that small amounts of iodine have been produced in Russia for a number of years from seaweed gathered in the White Sea by a Soviet co-operative organization known as the White Sea Iodine Company. A beginning was made in 1923, when the output was 50 kg., and in 1928 production amounted to 405 kg. It is now intended to work this industry on a large and more comprehensive scale, the objective being an output of 5,000 kg., in 1930, increasing by 5,000 kg. a year until it reaches 20,000 kg. in 1933. The Archangel Producers' Association, on the suggestion of the Iodine Commission of the Central Soviet Chemical Authority, has been investigating the matter and has calculated that the iodine can be produced at a cost of 37.50 rubles per kg.

Monsanto Acquires British Coal-Tar Company

FURTHER expansion of the activities of the Monsanto Chemical Works in Europe was completed early this month when a contract providing for the purchase of the Sunderland Tar Distilling Works of Brotherton & Company was ratified by the directors. The additional property will be taken over by the Graesser-Monsanto Chemical Works, Ltd., Monsanto's European subsidiary. The plant, which is in the County of Durham, England, has an annual distilling capacity of 60,000 tons of tar.



Firm Tone Underlies Price Outlook For Chemical Products

FOR the general run of commodities a slightly lower price level is anticipated for the coming year. Chemicals, however, may offer an exception, as current values appear to be on a basis where they may easily be sustained and in some cases advances are more probable than declines. Contract prices for such important chemicals as soda ash and caustic soda are the same as a year ago and while production in 1930 will be increased, there is no reason to expect a lowering in prices. Liquid chlorine is one of the few chemicals which have sold for next year's delivery at a reduction in price, but it is possible that an upward revision will be made after the turn of the year.

Sulphuric acid and other mineral acids are in a strong position which probably will be maintained in the future. The output of ammonia will be considerably enlarged next year, yet higher prices are expected to go into effect in January.

Industrial alcohol is in a position of uncertainty, as future producing costs are not well established. Blackstrap molasses is higher than a year ago and may advance further. In some cases alcohol producers are reported to have bought corn when that market was depressed, but in any case production costs for alcohol should average higher than in the current year. The possibility of synthetic ethyl alcohol production as a market factor is regarded as too remote to influence values in 1930.

Fertilizer chemicals, principally the nitrogen-bearing materials, have shown a declining price trend and with future production planned on a larger scale, competition in the coming year may establish new low levels.

The metal salts may be expected to follow the course of basic materials. Lead is in a fairly stable position with decreased production as a steadying factor. Copper is well controlled and less susceptible to statistical influences. Many large consumers are not covered ahead, and this prospective buying makes price declines improbable, but when contract commitments have been made, slightly lower prices may be quoted as an incentive to larger consumption. Tin promises to follow an irregular course, as overproduction is unchecked and competitive conditions are assured for some time to come. Zinc also is suffering from overproduction with no relief in sight for at least the first half of 1930.

Uncertainty regarding the outcome of tariff legislation makes it difficult to form a definite opinion regarding the future price movement for vegetable oils. Relatively high prices for linseed oil are indicated by the seed supply. An increased duty on flaxseed would further add to production costs. Cottonseed oil has been registering a heavy consumption but this has been offset by large supplies, and until new crop influences are met, the market should show no marked trend in either direction. High prices for linseed oil open up wider outlets for China wood oil with a strengthening effect on prices.

Crude menhaden oil is well sold ahead and only limited supplies will be available in the spot market for the next six months. Hence any change in spot prices should be toward higher levels.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.35**
Last month	112.44
December, 1928	112.82
December, 1927	112.08

Acids and alkalis maintain a steady price course and with contract levels well established future fluctuations should not be frequent. Higher prices ruled for borax during the month but weakness in methanol brought a decline in the index number.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**126.99**
Last month	128.22
December, 1928	124.16
December, 1927	128.30

Crude cottonseed oil is quiet and largely nominal in price. Linseed oil was lowered and China wood oil sold off appreciably. Menhaden oil is well sold up as far as future production is concerned with prices lower than a month ago. Coconut oil was easier in all positions.

Trade Leaders Optimistic on Industrial Outlook

REPORTS covering existing conditions and the outlook for the coming six months for thirty-two basic business groups and approximately one hundred and fifty specific industries were submitted to the National Business Survey Conference held at Washington, Dec. 5. The selected spokesmen for the various industries were men who are acknowledged leaders in their respective fields and, in most instances, their reports were featured by a note of optimism regarding the industrial outlook for 1930. Summaries of some of the reports covering commodity groups, are given below.

Chemicals

E. M. Allen, president of the Mathieson Alkali Works, reporting for the chemical industry as a whole, stated that the present year will be the largest and most prosperous year experienced in the chemical industry and should show 12 to 15 per cent ahead of 1928. Next year should be even greater than 1929.

The different branches of the Industry are planning on the following business for 1930, as compared with 1929:

Explosives, 2-3 per cent less; dyes, about same; rayon, decidedly larger; lacquers, alcohol, solvents, 10-15 per cent less; paint and varnishes, 5 per cent less; artificial leather, 10-15 per cent less; ammonia, larger; soda ash, larger; caustic soda, decidedly larger; chlorine, larger; sulphur, sulphuric acid, larger; fertilizers, about same; phosphoric acid, decidedly larger; patent and proprietary medicines and compounds, larger.

A careful survey of the chemical industry's plans for 1930 shows no curtailment of labor, no decrease in wages, no decrease in budgets for advertising, no decrease in capital expenditures, in fact is planning on a material increase, and it is expected the new expenditures will reach $350,000,000, divided $275,000,000 for industrial chemicals and $75,000,000 for the other chemical lines.

Salmon W. Wilder, chairman of the Executive Committee, Manufacturing Chemists' Association of the United States, summarized his report by saying that general business conditions were satisfactory, with sales substantially in excess of those for the corresponding period of a year ago. Some curtailment during the first half of 1930 is expected but a satisfactory year is anticipated. He also stated that plans for expansion would be carried out at a cost of upward of $250,000,000.

August Merz, president, Synthetic Organic Chemical Manufacturers' Association, advised that the organic chemical industry in general has a capacity for production which considerably exceeds the market demand and that no material expenditures for expansion are to be expected.

However, the development of petroleum byproducts has opened up a field hitherto unthought of. New products and new processes are continually being discovered. It is reasonably possible that there may be large expenditures in this branch of the industry.

Paint and Varnish

H. S. Chatfield, president, National Paint, Oil and Varnish Association, declared that the situation in paints, varnish materials, naval stores, flaxseed products, gums and waxes, compared with a year ago, taking 100 per cent as a base, indicates production to be 104.2; sales, 105.7; prices, 112.7; general conditions, 102.5; prosperity index, 115.4.

Breaking down the general group figures, the status of business in the industry shows production, 105.2; sales, 106.5; prices, 103.0; general conditions, 103.7; naval stores, production, 105.8; sales, 102.8; prices, 101.0; general conditions, 103.6; flaxseed products, production, 104.0; sales, 110.0; general conditions, 102.4; gums and waxes, production, 101.8; sales, 103.4; prices, 105.4; general conditions, 100.3.

Fertilizers

L. W. Rowell, president, National Fertilizer Association, showed that over a period of years fertilizer consumption has increased about 4 per cent per year. Last year there was a reduction of 5 per cent. If the normal rate of progress should be resumed, a gain of 9 per cent should be recorded during the 1929-1930 season.

Drugs

Carson P. Frailey, Drug Manufacturing Association, said that about 95 per cent of reports from the association membership indicate sales to be ahead for the year to Dec. 1, ranging from 10 per cent to 50 per cent. The entire membership expects either as good business for the next six months or substantial increases. Plans for expansion involving several million dollars are reported for the coming six months over the amount expended in corresponding six months of this year.

Automobiles

Alvan Macauley, president National Automobile Chamber of Commerce, reported that industry to be in a healthy condition. He cited the 25,000,000 motor vehicles in use in this country with an annual replacement of 2,750,000 cars. He placed export demand in 1930 at 1,000,000 units which with replacements and new buying would give an outlet for 5,000,000 units compared with 5,600,000 units produced in the current year.

Petroleum

J. F. Lucey, representing the American Petroleum Institute, pointed out voluntary action by producers had curtailed production of crude oil to approximate equilibrium with refinery demand. He stated that the oil industry is in better condition than it was a year ago, than it was six months ago, and than it was 90 days ago. The weak point is the overproduction of gasoline.

Steel

James A. Farrell, president, U. S. Steel Corporation, emphasized the large earnings of this year and stated this would enable the industry to make long deferred improvements. Expenditures definitely planned approximate $500,000,000. Present rate of operation was placed at 65 per cent of capacity and a good average year was anticipated for 1930.

Transportation

R. H. Aishton, chairman, Association of Railway Executives, declared the situation in the railroad industry as of Oct. 1 showed a greater authorized program of improvements and expenditures under way than in any similar period for the last five years. Briefly it calls for an expenditure within the next few months of $674,000,000, or $272,000,000 more than for the corresponding period of 1928.

Utilities

Matthew S. Sloan, president New York Edison Company, reported that public utilities will spend $1,400,000,000 in 1930 for new construction, an increase of $110,000,000 over 1929. He described business as showing a normal growth this year with no apparent reason why it should not continue to grow during 1930.

Machinery

General Otto H. Falk, president Allis-Chalmers Manufacturing Company, referred to 1929 as the biggest year in machinery history. He found no recession in business as a result of the drop in securities and gave the industry's view of 1930 as anticipating little if any change from 1929.

Construction

General R. C. Marshall, Jr., representing the Associated General Contractors of America, said that money is flowing back into investment channels and stimulating the demand, particularly for residential construction. The president of the Real Estate Board of Chicago advised of an active shortage in that city. Similar shortages in other localities combined with the stimulating effects of the President's conferences, appear to insure in all branches of the industry an increased program for next year.

Textiles

Walter D. Hines, Cotton Textile Institute, described the cotton textile industry as greatly encouraged by the reassurance of business and as showing greater appreciation of the necessity of stabilization through keeping production in reasonable balance with demand.

Franklin W. Hobbs, president, National Association of Wool Manufacturers, estimated operations in that branch at 50 per cent of capacity.

MARKET APPRAISAL OF CHEMICAL INDUSTRY

Liquid Carbonic Corporation reports for the year ended Sept. 30 consolidated net profits of $1,903,528, equal to $6.12 a share on 311,131 common shares, compared with $1,415,367, or $4.54 a share, in the preceding year.

Consolidated Chemical Industries, Inc., will sell an additional 40,000 shares of its class A stock at $26 a share. Proceeds from the sale will be used to expand the company's plants at San Francisco, Houston, Texas, and Baton Rouge, La.

Westvaco Chlorine Products Company and subsidiaries report for the nine months ended Sept. 30 a net income of $841,840, or $3.21 a common share, compared with $481,756, or $1.61 a share, in the corresponding 1928 period.

Duval Texas Sulphur Company stockholders have approved a change in capitalization from 100,000 shares of $10 par value capital stock now outstanding to 550,000 shares of no par value. Five new shares will be issued for each share now held.

Gold Dust Corporation has listed 37,825 additional common stock on New York Stock Exchange, to be sold to employes at $20 a share. It was originally planned to offer stock at $40 a share, but the plan was changed owing to market conditions.

Spencer Kellogg & Sons, Inc., and subsidiaries report for year ended Sept. 28, 1929, net profit of $1,297,730 after depreciation, interest and federal taxes, equivalent to $2.54 a share earned on average of 510,137 no-par shares of common stock outstanding during the year and $2.36 a share on 550,000 common shares outstanding at close of year. In year ended Sept. 29, 1928, net profit was $1,710,497 after charges, equal to $3.42 a share on 500,000 common shares outstanding at close of that year.

Allied Chemical & Dye Corporation has declared 5 per cent stock dividend. With 2,178,109 common shares outstanding, this extra calls for the distribution of 108,905 shares, having a current market value at $240 a share of $26,137,200. There are 965,346 common shares in the treasury to take care of the current and future stock dividends. Directors said the company's economic progress indicated continuation of an annual stock dividend.

The Newport Company has announced the acquisition of the Acetol Products Company. The Acetol company has a factory at New Brunswick, N. J., and makes "cello-glass" under a patented process.

Monsanto Chemical Works reports net profit for nine months ended Sept. 30, 1929, was $878,840 after charges equal to $2.83 a share on 310,852 shares of stock, compared with net profit of $682,980 or $2.23 a share on present share basis in first nine months of previous year.

Price Range Jan.-Nov. High	Price Range Jan.-Nov. Low	Stock	Price Range in November — Nov. 4	High	Low	Nov. 27
223⅛	77	Air Reduction	131⅛	142½	77	129
11½	2	Ajax Rubber	3	3½	2	2⅛
354⅛	197	Allied Chemical	235	256	197	243½
125	118½	Allied Chemical, pf	122½	123½	118½	....
23⅜	4	Am. Ag. Chemical	7⅛	7¼	5⅛	6⅛
73½	18	Am. Ag. Chemical, pf	29	29½	18	26½
69⅜	20½	American Cyanamid B	31⅛	40	20½	28½
10	3⅛	American Hide & Leather	5½	5⅛	3⅛	4½
81½	31½	American Metal	52⅛	52⅛	31½	42½
37	10⅛	Am. Solvents & Chemical	20⅛	20⅛	10⅛	....
45½	15	Anglo-Chile Nitrate	27	27	....	21⅛
49½	18½	Archer-Daniels-Midland	30	31	18½	25
27⅜	3	Assoc. Dyeing & Printing	5	5⅞	3	....
140	67	Atlas Powder	98½	99½	67	81
32⅛	15	Beacon Oil	21	22⅛	15	16½
101	45	Beechnut Packing	74	78½	45	....
89½	70	Bon Ami, A	....	75	71	71
31	25	California Petroleum	....	28	28	....
57½	20	Celanese	30	31	27	....
122	80	Celanese, pf	90	90	80	85½
32	11½	Certainteed	17⅛	18	11½	14
50	27½	Chickasha Cotton Oil	30½	30½	27½	28⅛
90	40	Colgate-Palmolive-Peet	64	65	40	57⅛
63	20½	Commercial Solvents	33½	36½	20½	27⅞
126½	70	Corn Products	99	104	70	88½
69⅛	21½	Davison Chemical	36	37⅛	25	28⅛
64⅜	24	Devoe & Raynolds	38	39⅛	24	37
115½	112	Devoe & Raynolds, pf	....	....	....	....
231	80	Du Pont	130	136½	80	111
119⅛	96½	Du Pont, 6 per cent deb	115	116	96½	116
264⅛	150	Eastman Kodak	193	205	150	175
41½	30	Firestone Tire	41	41½	30	36
20⅛	3½	Fisk Rubber	5⅛	5⅛	3½	4½
54⅛	23⅛	Freeport Texas	35½	36⅛	23⅛	35⅛
64⅛	26	Glidden Co	38⅛	38⅛	27	35
106⅛	95	Glidden Co., pf	103	103	95	101
82	31⅛	Gold Dust	44⅛	48⅛	34⅛	40½
105⅛	42	Goodrich Co	55	56	42	45½
130	80	Hercules Powder	90	90	80	....
109	26	Houston Oil	51½	54½	42	47
135	68½	Industrial Rayon	89	89	68½	85
17⅜	4	Int. Ag. Chemical	5⅛	6	4	4½
88⅛	40	Int. Ag. Chemical, pf	57⅛	57½	40	48
44⅛	20	International Paper A	31⅛	32	20	29½
90	55½	International Salt	....	65	63	....
24	3⅛	Kelly-Springfield	6½	7	3⅛	4½
25	5	Lee Rubber & Tire	8	8⅛	5½	7
43	17	Libby-Owens	26½	28⅛	21½	21⅛
113⅛	40	Liquid Carbonic	56⅛	59⅛	40⅛	55
72⅛	29	Mathieson Alkali	42⅛	46	33	39⅛
80½	47	Monsanto Chemical	71	71	47	50
58	15	Nat'l Distillers Products	30	41⅛	26½	35
210	129½	National Lead	150	150	129½	140
87⅛	60½	New Jersey Zinc	78	78	60½	....
79⅜	64½	Ohio Oil	72½	73	65½	70½
89½	43	Owens-Ill. Glass	60	60½	43	53
47	24⅛	Phillips Petroleum	33½	39	24½	38
76⅛	50	Pittsburgh Plate Glass	59⅛	59⅛	50	54½
85	55	Pratt & Lambert	65	65	55	59⅛
98	43½	Procter & Gamble	70½	72	43½	57⅛
30½	20	Pure Oil	24½	25½	20	22½
105⅛	75½	Sherwin-Williams	....	84½	75½	....
48⅜	15	Silica Gel	23	24½	15	15⅜
45	21	Sinclair Oil	29	30	21	26⅛
46⅛	28	Skelly Oil	33⅛	34⅛	30	33⅛
81⅛	51½	Standard Oil, Cal	67⅛	69	56	62
83	48	Standard Oil, N. J	66⅛	69⅛	50	64
48⅛	31⅛	Standard Oil, N. Y	37⅛	39½	31⅛	35⅛
9⅛	1⅛	Standard Plate Glass	2⅛	3	1⅛	2⅛
86⅛	55½	Sun Oil	70	70	55½	60
18	10	Swan & Finch	....	10	10	....
20⅜	9½	Tennessee Copper & Chemical	13⅜	14	9½	12
71⅛	50	Texas Corporation	56⅛	58⅛	50	56
85⅛	42⅛	Texas Gulf Sulphur	59⅛	62	42⅛	56⅛
40	14	Tidewater Oil	....	23⅛	14	20⅛
550	111	Tubize Silk	219	219	111	160
140	59	Union Carbide	87	93	59	77
57	42⅛	Union Oil, Cal	48⅛	49⅛	42⅛	44⅛
48⅜	15⅛	United Piece Dye	28	28	15⅛	20
243⅛	95	U. S. Ind. Alcohol	144⅛	152⅛	95	136⅛
35⅛	5	U. S. Leather	13	14⅛	5	10⅛
65	15	U. S. Rubber	32	36⅛	25	26⅛
133⅛	75⅛	Vacuum Oil	103⅛	109½	88	94⅛
116⅛	37⅛	Vanadium Corp	60	62	37⅛	52
51⅛	33	Vick Chemical	41	41	35	35⅛
24⅛	3⅛	Va.-Car. Chemical	7⅛	8	4⅛	6
65⅛	15	Va.-Car. Chemical, pf	23⅛	30⅛	19	28⅛
48	20	Wesson Oil	28	30	22	26
13⅛	3⅛	Wilson & Co	4⅛	5	3⅛	4

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Dec. 14.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.11 -$0.12	$0.14 -$0.15	$0.14 -$0.15
Acid, acetic, 28%, bbl., cwt.	3.88 - 4.03	3.88 - 4.03	3.88 - 4.03
Boric, bbl, lb.	.06½- .07	.06½- .07	.06½- .07
Citric, kegs, lb.	.46 - .47	.46 - .47	.46 - .47
Formic, bbl, lb.	.10½- .11	.10½- .11	.11 - .12
Gallic, tech., bbl., lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb, lb.	.06 - .07	.06 - .07	.06 - .07
Latic, 44%, tech., light, bbl., lb.	.11½ - .12	.11 - .11½	.12 - .12½
22%, tech., light, bbl., lb.	.05½- .06	.05½- .06	.05½- .06
Muriatic, 18°, tanks, cwt.	1.00 - 1.10½	1.00 - 1.10	.85 - .90
Nitric, 36°, carboys, lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl., lb.	.11½- .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys., lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks, ton	11.00 -11.50	11.00 -11.50	11.00 -11.50
Tannic, tech., bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl., lb.	.38½- .39	.38½- .39	.38 - .39
Tungstic, bbl., lb.	1.40 - 1.50	1.30 - 1.40	1.00 - 1.20
Alcohol, ethyl, 190 p'f., bbl., gal.	2.68½- 2.71	2.68½- 2.71	2.68½- 2.71
Alcohol, Butyl, tanks, lb.	.16½- .17	.16½- .17	.18½- .19
Denatured, 190 proof			
No. 1 special dr., gal.	.52 -.....	.51 -	.48 -.....
No. 5, 188 proof, dr., gal.	.52 -.....	.51 -	.48 -.....
Alum, ammonia, lump, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl., lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl., lb.	.03 - .03½	.03 - .03½	.02½- .03½
Aluminum sulphate, com., bags, cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg., cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums, lb.	.03 - .04	.03 - .04	.03 - .04
Ammonia, anhydrous, cyl., lb.	.14 -.....	.14 -.....	.13½-.....
Ammonium carbonate, powd. tech., casks, lb.	.12 - .13	.12 - .13	.12 - .13
Sulphate, wks., cwt.	2.10 -.....	2.10 -.....	2.40 -.....
Amylacetate tech., drums, gal.	1.70 - 1.90	1.75 - 2.00	1.75 - 2.00
Antimony Oxide, bbl., lb.	.09 - .10	.09 - .10	.09 - .10
Arsenic, white, powd., bbl., lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs., lb	.09 - .10	.09 - .10	.09 - .10
Barium carbonate, bbl., ton	58.00 -60.00	58.00 -60.00	57.50 -60.00
Chloride, bbl., ton	64.00 -65.00	65.00 -67.00	64.00 -70.00
Nitrate, cask, lb.	.07 - .07½	.07½- .08	.08 - .08½
Blanc fixe, dry, bbl., lb.	.03½- .04	.03½- .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl., lb.	.033- .033	.033- .033	.02½- .03
Bromine, cs., lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags., cwt.	4.50 -.....	4.50 -.....	4.00 -.....
Arsenate, dr., lb.	.07 - .08	.07 - .10	.06½- .07
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks., ton.	20.00 -.....	20.00 -.....	20.00 -.....
Phosphate, bbl., lb.	.08 - .08½	.08 - .08½	.07 - .07½
Carbon bisulphide, drums, lb.	.05 - .06	.05 - .06	.05 - .06
Tetrachloride drums, lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks., lb.	.02½-	.02½-	.03½- .04½
Cylinders	.04½- .06	.05 - .08	.05½- .08
Cobalt oxide, cans, lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks., ton.	15.00 -16.00	15.00- 16.00	16.00 -17.00
Copper carbonate, bbl., lb.	.22 - .23	.22 - .23	.17 - .18
Cyanide, tech., bbl., lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl., cwt.	5.50 - 6.00	6.00 - 6.10	5.30 - 5.50
Cream of tartar, bbl., lb.	.26½- .27	.26 - .26½	.27½- .28
Diethylene glycol, dr., lb.	.10 - .15	.10 - .15	.10 - .15
Epsom salt, dom., tech., bbl., cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags, cwt.	1.15 - 1.25	1.15 - 1.25	1.15 - 1.25
Ethyl acetate, drums, bl.	109½-	12.5 -.....	12.5 -.....
Formaldehyde, 40%, bbl., lb.	.08½- .09	.08½- .09	.09½- .10½
Furfural, dr., lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums, gal.	1.30 - 1.40	1.30 - 1.40	1.30 - 1.40
Refined, dr., gal.	1.90 - 2.00	1.90 - 2.00	2.50 - 3.00
Galubers salt, bags, cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, c.p., drums, extra., lb.	.14 - 14½	.14 - .14½	.14 - .15
Lead:			
White, basic carbonate, dry casks, lb.	.09 -.....	.09 -.....	.08½-.....
White, basic sulphate, sck., lb.	.08½-.....	.08½-.....	.07½-.....
Red, dry, sck., lb.	.09½-.....	.09½-.....	.09½-.....
Lead acetate, white crys., bbl., lb.	.13 - .14	.13 - .14	.13 - .13½
Lead arsenate, powd., bbl., lb.	.14 - .15	.13 - .14	.12 - .13
Lime, chem., bulk, ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, pwd., csk, lb.	.08½-	.08½-	.08½- .....
Lithopone, bags, lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags, lb.	.06 - .06½	.06 - .06½	.06½- .07
Methanol, 95%, tanks, gal.	.48 -.....	.55 -.....	.55 -.....
97%, tanks, gal.	.50 -.....	.55 -.....	.55 -.....
Nickel salt, double, bbl., lb.	.13 - .13½	.13 - .13½	.10 - .11
Single, bbl., lb.	.13 - .13½	.13 - .13½	.10½- .11½
Orange mineral, csk., lb.	$0.11½-	$0.11½-	$0.11½- .....
Phosphorus, red, cases, lb.	.37½- .42	.55 - .57	.62 - .65
Yellow, cases, lb.	.31 - .32	.32 - .34	.32 - .33
Potassium bichromate, casks, lb.	.09 - .09½	.09 - .09½	.09 - .09½
Carbonate, 80-85%, calc., csk., lb	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd., lb.	.08 - .08½	.07½- .08½	.06½- .07
Cyanide, cs., lb	.52 - .55	.52 - .55	.51 - .53
First sorts, csk., lb.	.08½- .09	.08½- .09	.08½- .09
Hydroxide (c'stic potash) dr., lb.	.06½- .06½	.06½- .06½	.07½- .07½
Muriate, 80% bgs., ton	36.75 -.....	36.75 -.....	36.40 -.....
Nitrate, bbl., lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums, lb.	.16 - .16½	.16 - .16½	.15 - .16
Prussiate, yellow, casks, lb.	.18½- .19½	.18½- .19	.18 - .19
Sal ammoniac, white, casks, lb.	.046- .05	.046- .05	.047- .05
Salsoda, bbl., cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk, ton	22.00 -24.00	22.00 -24.00	14.00 -17.00
Soda ash, light, 58%, bags, contract, cwt.	1.32 -.....	1.32 -.....	1.32 -.....
Dense, bags, cwt.	1.35 -.....	1.35 -.....	1.35 -.....
Soda, caustic, 76%, solid, drums, contract, cwt.	2.90 - 3.00	2.90 - 3.00	2.90 - 3.00
Acetate, works, bbl., lb.	.05½- .05½	.06 - .06½	.05½- .06
Bicarbonate, bbl., cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks, lb.	.07 - .07½	.07 - .07½	.07 - .07½
Bisulphate, bulk, ton	16.00 -18.00	15.00 -16.00	3.00 - 3.50
Bisulphite, bbl., lb.	.03½- .04	.03½- .03½	.03½- .04
Chlorate, kegs, lb	.07½- .08	.07 - .07½	.06½- .06½
Chloride, tech., ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom., lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl., lb.	.08½- .09½	.08½- .09½	.08½- .09
Hyposulphite, bbl., lb	2.40 - 2.50	2.50 - 3.00	2.50 - 3.00
Nitrate, bags, cwt.	2.10 -.....	2.10 -.....	2.15 -.....
Nitrate, casks, lb.	.07½- .08	.07½- .08	.07½- .08
Phosphate, dibasic, bbl., lb.	.03½- .03½	.03½- .03½	.03½- .03½
Prussiate, yel. drums, lb	.11½- .12	.11½- .12	.11½- .12
Silicate (30°, drums), cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr., lb.	.02½- .03½	.02½- .03	.03½- .04
Sulphite, cyrs., bbl., lb.	.03 - .03½	.02½- .03	.02½- .03
Strontium nitrate, bbl., lb.	.09 - .09½	.09 - .09½	.09 - .09½
Sulphur, crude at mine, bulk, ton	18.00 -.....	18.00 -.....	18.00 -.....
Chloride, dr., lb.	.05 - .06	.04 - .05	.04 - .05
Dioxide, cyl., lb.	.07 - .08	.07 - .08	.09 - .10
Flour, bag, cwt.	1.55 - 3.00	1.55 - 3.00	1.55 - 3.00
Tin bichloride, bbl., lb.	.13½-	.13½-	.15½- .....
Oxide, bbl., lb.	.42 -.....	.44 -.....	.53 -.....
Crystals, bbl., lb.	.32½-	.35 -.....	.37½- .....
Zinc chloride, gran., bbl., lb.	.06½- .06½	.06½- .06½	.06½- .06½
Carbonate, bbl., lb.	.10½- .11	.10 - .10½	.10 - .11
Cyanide, dr., lb.	.41 - .42	.40 - .41	.40 - .41
Dust, bbl., lb.	.09½- .10	.08½- .09	.09 - .10
Zinc oxide, lead free, bag, lb.	.06½-	.06½-	.06½- .....
5% lead sulphate, bags, lb.	.06½-	.06½-	.06½- .....
Sulphate, bbl., cwt.	3.00 - 3.25	2.75 - 3.00	2.75 - 3.00

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.12½-$0.13	$0.12 -$0.13	$0.13½-$0.14
Chinawood oil, bbl., lb.	.14½-	.15 -.....	.14½- .....
Coconut oil, Ceylon, tanks, N.Y., lb.	.07 -	.07½-	.08½- .....
Corn oil crude, tanks, (f.o.b. mill), lb.	.08 -	.07½-	.08½- .....
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.07½-	.07½-	.08½- .....
Linseed oil, raw, car lots, bbl., lb.	.14.9 -	14.5 -.....	.10 - .....
Palm, Lagos, casks, lb	.07½-	.07 -	.09 - .....
Niger, casks, lb.	.07½-	.06½-	.08½- .....
Palm Kernel, bbl., lb.	.07½-	.07½-	.09½- .....
Peanut oil, crude, tanks (mill), lb	.07½-	.08½-	.10 - .....
Rapeseed oil, refined, bbl., gal.	.71 - .73	.71 - .73	.82 - .84
Soya bean tank (f.o.b. Coast), lb	.09½-	.10½-	.09½- .....
Sulphur (olive foots), bbl., lb.	.08 -	.08½-	.10½- .....
Cod, Newfoundland, bbl., gal.	.57 - .60	.65 - .67	.68 - .69
Menhaden, light pressed, bbl., gal.	.64 - .66	.64 - .66	.60 - .61
Crude, tanks (f.o.b. factory), gal.	.45 -	.48 -.....	.48 -.....
Whale, crude, tanks, gal.	.78 -.....	.80 -.....	.... - .....
Grease, yellow, loose, lb.	.06½-	.06½-	.07½- .....
Oleo stearine, lb.	.11½-	.11½-	.09½- .....
Red oil, distilled, d.p. bbl., lb.	.10½- .11	.09½- .10	.09½- .09½
Tallow, extra, loose, lb.	.07½-	.07½-	.08½- .....

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.85 - .90
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.35 - .36
Aniline oil, drums, extra, lb.	.14½- .15	.14½- .15	.15 - .16
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums, lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr., lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl., lb.	.65 - .67	.65 - .67	.70 - .72
Benzoic acid, U.S.P., kgs, lb.	.51 - .60	.51 - .60	.58 - .60
Benzyl chloride, tech., dr., lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works, gal.	.23 - .25	.23 - .25	.22 - .23
Beta-naphthol, tech., drums, lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr., lb.	.14 - .17	.14 - .17	.18 - .20
Cresylic acid, 97%, dr., wks., gal.	.67 - .70	.70 - .72	.73 - .75
Diethylaniline, dr., lb.	.55 - .58	.55 - .58	.58 - .60
Dinitrophenol, bbl., lb.	.30 - .32	.30 - .31	.31 - .35
Dinitrotoluen, bbl., lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr., gal.	.26 - .28	.26 - .28	.28 - .30
Diphenylamine, bbl., lb.	.40 - .42	.42 - .43	.45 - .47
H-acid, bbl., lb.	.65 - .70	.65 - .70	.63 - .65
Naphthalene, flake, bbl., lb.	.04½- .05	.04½- .05	.05 - .06
Nitrobensene, dr., lb.	.08½- .10	.09 - .10	.08½- .10
Para-nitraniline, bbl., lb.	.51 - .55	.55 - .56	.52 - .53
Para-nitrotoluine, bbl., lb.	.28 - .31	.29 - .31	.28 - .32
Phenol, U.S.P., drums, lb.	.14½- .15	.13½- .15	.15 - .17
Picric acid, bbl., lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., lb.	1.75 - 1.90	1.75 - 1.90	1.35 - 1.50
R-salt, bbl., lb.	.44 - .45	.44 - .45	.47 - .50
Resorcinal, tech., kegs, lb.	1.15 - 1.30	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl., lb.	.33 - .35	.30 - .32	.30 - .32
Solvent naphtha, w.w., tanks, gal.	.30 - .35	.30 -.....	.35 -.....
Tolidine, bbl., lb.	.86 - .90	.86 - .90	.95 - .96
Toluene, tanks, works, gal.	.40 -.....	.45 -.....	.35 -.....
Xylene, com., tanks, gal.	.40 - .45	.30 - .35	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl., lb.	.15 - .16	.15½- .16	.16½- .17
China clay, dom., f.o.b. mine, ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.06 - .13	.08 - .13	.06½- .07
Prussian blue, bbl., lb.	.35 - .36	.35 - .36	.31 - .32
Ultramine blue, bbl., lb.	.06 - .32	.06 - .32	.08 - .35
Chrome green, bbl., lb.	.27 - .28	.30 - .32	.27 - .30
Carmine red, tins, lb.	6.00 - 6.50	6.00 - 6.50	5.25 - 5.50
Para toner, lb.	.75 - .80	.75 - .80	.70 - .80
Vermilion, English, bbl., lb.	1.90 - 2.00	1.90 - 2.00	1.80 - 1.85
Chrome yellow, C. P., bbl., lb.	.17 - .17½	.17 - .17½	.15½- .16
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	5.75 - 7.00
Graphite, Ceylon, lump, bbl., lb.	.04 - .05	.04 - .05	.08 - .09
Cum copal Congo, bags, lb.	.07½- .08	.07½- .08	.07½- .08
Manila, bags, lb.	.16 - .17	.16 - .17	.15 - .18
Damar, Batavia, cases, lb.	.21 - .22	.24 - .25	.22 - .23
Kauri No. 1 cases, lb.	.45 - .50	.48 - .53	.48 - .53
Kieselguhr (f.o.b. N. Y.), lb.	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton	40.00 -.....	40.00 -.....	40.00 -.....
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	8.60 -.....	8 75 -.....	9.50 -.....
Turpentine, gal.	.54 -.....	.52½-.....	.59 -.....
Shellac, orange, fine, bags, lb.	.59 - .60	.59 - .60	.61 - .62
Bleached, bonedry, bags, lb.	.52 - .54	.52 - .54	.56 - .60
T. N. bags, lb.	.35 - .36	.35 - .36	.46 - .47
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton	9.50 -.....	9.50 -.....	10.50 -.....
300 mesh (f.o.b. Ga.), ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
325 mesh (f.o.b. N. Y.), ton	13.75 -.....	13.75 -.....	13.75 -.....

	Current Price	Last Month	Last Year
Wax, Bayberry, bbl., lb.	$0.28 -$0.30	$0.28 -$0.31	$0.31 -$0.32
Beeswax, ref., light, lb.	.38 - .39	.38 - .40	.41 - .42
Candelilla, bags, lb.	.21 - .23	.22 - .23	.23 - .24
Carnauba, No. 1, bags, lb.	.35 - .36	.33 - .34	.50 - .51
Paraffine, crude			
105-110 m.p., lb.	.04½- .05	.04½- .05	.04½- .05

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferromanganese, 78-82%, ton	100.00-.....	105.00-.....	105.00-.....
Spiegeleisen, 19-21%, ton	33.00-.....	33.00-.....	32.00-.....
Ferrosilicon, 14-17%, ton	45.00-.....	45.00-.....	45.00-.....
Ferrotungsten, 70-80%, lb.	1.45	1.45-.....	1.35- .98
Ferro-uranium, 35-50%, lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%, lb.	3.15- 3.75	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb.	$0.18 -.....	$0.18 -.....	$0.16 -.....
Aluminum, 96-99%, lb.	.24 - .30	.24 - .26	.24 - .25
Antimony, Chin. and Jap., lb.	.08½-.....	.08½-.....	.11½-.....
Nickel, 99%, lb.	.35 -.....	.35 -.....	.35 -.....
Monel metal, blocks, lb.	.28 -.....	.28 - .28	.28 -.....
Tin, 5-ton lots, Straits, lb.	.41½-.....	.39½-.....	.49 -.....
Lead, New York, spot, lb.	.06½-.....	.06½-.....	.06½-.....
Zinc, New York, spot, lb.	.06 -.....	.0655 -.....	.067 -.....
Silver, commercial, oz.	.49½-.....	.49½-.....	.57½-.....
Cadmium, lb.	.85 - .95	.85 - .95	.70 - .80
Bismuth, ton lots, lb.	1.70 -.....	1.70 -.....	1.70 -.....
Cobalt, lb.	2.10 - 2.50	2.10 - 2.50	2.50 -.....
Magnesium, ingots, 99%, lb.	.85 - 1.10	.85 - 1.10	.85 - 1.10
Platinum, ref., oz.	65.00- 66.00	65.00- 66.00	76.00-76.50
Palladium ref., oz.	35.00- 36.00	38.00- 40.00	42.00-46.00
Mercury, flask, 75 lb.	124.00-.....	124.50-.....	122.00-.....
Tungsten powder, lb.	1.35- 1.50	1.35- 1.50	1.10- 1.15

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton	$7.50- $8.00	$7.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post, ton	21.50- 25.00	22.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens, ton	2.75- 2.85	2.85- 3.00	2.85- 3.00
Fluorspar, gravel, f.o.b. Ill., ton	18.00- 20.00	18.00- 20.00	17.00-18.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit	.31 - .36	.31 - .36	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb.	.48 - .50	.48 - .50	.48- .50
Monazite, 6% of ThO_2, ton	60.00-.....	80.00-.....	130.00-.....
Pyrites, Span. fines, c.i.f., unit	.13 -.....	.13 -.....	.13 -.....
Rutile, 94-96% TiO_2, lb.	.10 - .11	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO_3 and over, unit	15.25- 16.50	16.00 -17.00	11.25 -11.50
Vanadium ore, per lb. V_2O_5, lb.	28.00- 28.00	.28 -.....	nom. - nom.
Zircon, 99%, lb.	.03 -.....	.03 -.....	.03 -.....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Brass Rolling Mill—Platt Bros. & Co., Platts Mills, Waterbury, Conn., awarded contract for a 1 story, 75 x 140 ft. addition to brass rolling mill to C. H. Kinney Co., Inc., 525 Watertown Ave., Waterbury. Estimated cost $42,000.

Brass Shop Addition—American Brass Co., Meadow St., Waterbury, Conn., awarded contract for addition to brass shop, also two frame lumber sheds, each 200 ft. long, to G. A. Upham Inc., West Main and Ferry Sts., Waterbury. Private plans.

Copper and Cable Factory—Anaconda Copper & Cable Co., Anderson, Ind., is receiving bids for the construction of a 1 story, 100 x 200 ft. factory on East 31st St. Estimated cost $40,000. New machinery and equipment for wire making will be required.

Copper Factory Addition—Taunton & New Bedford Copper Co., 24 North Front St., New Bedford, Mass., awarded contract for additions and alterations to factory on North Front St. to W. Young, 122 Union St., New Bedford. Estimated cost $40,000.

Calcium Chloride — County Board, Hurley, Wis., voted $10,000 for purchase of calcium chloride for dust laying purposes on gravel roads. W. Weber, comr.

Chlorine Control Apparatus Factory—Wallace & Tiernan Co., Inc., 11 Mill St., Belleville, N. J., plans addition to factory for the manufacture of chlorine control apparatus. Estimated cost $40,000. Architect not selected.

Celluloid Plant — Bachman Bros. Inc., 609 Commerce St., Philadelphia, Pa., will soon award contract for the construction of a 2 story, 110 x 220 ft. celluloid plant at Erie and M. Sts. Estimated cost $200,000. E. A. Stopper, 10 South 18th St., Philadelphia, is architect.

Cement Plant — National Portland Cement Co., Santa Fe Bldg., Dallas, Tex., acquired a 46 acre site at Fort Hill, Vicksburg, Miss., and plans the construction of a cement plant, 3,500 bbl. daily capacity. Estimated cost $1,000,000.

Cement Sacking Plant and Storage Bins—Canada Cement Co., Canada Cement Bldg., Montreal, Que., awarded contract for the construction of cement storage bins and sacking plant to Wilde & Brydon, Canadian Pacific Railroad Bldg., Toronto, Ont. Estimated cost $100,000. S. W. Barr, Canada Cement Bldg., Montreal, Que., is chief engineer.

Chemical and Ammonia Buildings—Canadian Industries Ltd., Sandwich, Ont., plans a 60 x 100 ft. addition to chemical building; also a new 100 x 100 ft. building for the manufacture of ammonia. Estimated cost $170,000. Work will be done under the supervision of A. E. Moreton, c/o owner, Engr. Special equipment will be installed.

Chemical Plant Addition — Davison Chemical Co., Curtis Bay, Baltimore, Md., plans the construction of a 2 story addition to chemical plant. Estimated cost $200,000. Maturity 1930.

Chemical Plant Addition—Monsanto Chemical Works, 1900 South Second St., St. Louis, Mo., awarded contract for a 1 story, 60 x 102 ft. addition to chemical plant, to Westlake Construction Co., 1919 Railway Exchange Bldg., St. Louis.

Chemical Plant Addition—Raffi & Swanson, 1012 Broadway, Chelsea, Mass., plans a 1 story addition to chemical factory. Estimated cost $40,000. Private plans.

Coke Ovens — Colorado Fuel & Iron Co., Boston Bldg., Denver, Colo., A. Raeder,, Denver, Pres., appropriated $1,000,000 for adding 46 coke ovens to present battery of ovens at Minnequa steel plant, Pueblo.

Coke Screening Equipment, etc. — American Steel & Wire Co., Frick Bldg., Pittsburgh, Pa., awarded contract for new stock house at blast furnaces, new lorry cars and coke screening equipment in connection with plant at Donora to A. G. McKee & Co., 2422 Euclid Ave., Cleveland, O. Estimated cost $1,000,000.

Coking and Coal Tar Plant—F. R. Wood & Associates, c/o Temple Fuel Co., Trinidad, Colo., plans the construction of first unit of coking

and coal tar plant. $100,000. Total cost $500,000.

Cork Products Factory — Mitchell & Smith, Copeland Ave., Detroit, Mich., awarded contract for 1 and 2 story, 80 x 170, 120 x 120 and 25 x 50 ft. cork products factory to Austin Co., General Motors Bldg., Detroit. Estimated cost $75,000. Equipment for grinding cork and leather will be required.

Feldspar Plant—American Mineral Products Co. Inc., W. B. Ewing, Hartford, Conn., will build a 1 story, 40 x 200 ft. feldspar plant at Walpole, N. H. Estimated cost $40,000. W. Furey, 983 Main St., Hartford, Conn., is architect. Work will be done by day labor.

Ferro Alloy Factory—Fitzgerald Laboratories, Niagara Falls, N. Y., will build a plant for the manufacture of ferro alloys including two special furnaces on Hudson St., Sault Ste Marie, Ont. Estimated cost $100,000.

Foil & Metal Factory—Johnston Tin Foil & Metal Co., 6106 South Broadway, St. Louis, Mo., is having preliminary plans prepared for a 2 story, 100 x 104 ft. addition to factory. C. H. Deiterling, 1320 Central National Bldg., St. Louis, is architect.

Factory—Yardley & Co. of Canada, Ltd., 358 Adelaide St. W., Toronto, Ont., plans the construction of a 5 story, 80 x 133 ft. factory for the manufacture of toilet preparations. Estimated cost $150,000. Chapman & Oxley, Sterling Tower Bldg., Toronto, are architects.

Drying Oven Building—Multibestos Co., South St., Walpole, Mass., will soon award contract for addition and alterations to drying oven building. Lockwood Greene Engrs., Inc., 24 Federal St., Boston, are engineers.

Kiln Building — Carborundum Co., Niagara Falls, N. Y., awarded contract for addition to kiln building No. 32 on Buffalo Ave. to C. A. Harding Construction Co., 1335 Main St., Buffalo. Estimated cost $45,000.

Gas Generator Plant—Bridgeport Gas Light Co., 815 Main St., Bridgeport, Conn., awarded contract for the construction of a 1 and 2 story addition to gas generator plant at Howard Ave. to T. J. Pardy Construction Co., 1481 Seaview Ave., Bridgeport. Estimated cost $25,000.

Glass Plant—Brockway Machine Bottling Co., A. A. McFadden, Pres., Brockway, Pa., will soon award contract for the construction of a group of buildings for glass plant at Falls Creek. Estimated cost $90,000. Private plans.

Glass Plant — Corning Glass Co., Corning, N. Y., awarded contract for the construction of a 1 and 2 story, 140 x 450 ft. glass plant and boiler house to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $600,000.

Glass Factory — Pittsburgh Plate Glass Co., Barberton, O., awarded contract for the construction of a 2 story factory to Clemmer-Noah Co., Akron. Estimated cost $50,000.

Glassware Factory—Macalaster-Bicknell Co., 28 Wendell St., Cambridge, Mass., plans the construction of a factory for the manufacture of glassware at Moore and Washington Sts. Estimated cost $40,000. Architect not selected.

Laboratories — Eastern State Normal School, Morehead, Ky., will receive bids until Dec. 20, for the construction of a 3 and 4 story, 55 x 203 ft. school including laboratories, etc. Estimated cost $200,000. Joseph & Joseph, Breslin Bldg., Louisville, are architects and engineers.

Laboratory (Medical) — University of Cincinnati, Clifton Ave., Cincinnati, O., plans a 4 story laboratory on Burnet St. Estimated cost $150,000. S. Hannaford & Sons, Dixie Terminal, Cincinnati, are architects.

Laboratory—Standard Oil Co. of New York, 26 Broadway, New York, N. Y., awarded contract for the construction of a laboratory at Brooklyn to C. Curtis Woodruff, 213 10th St., Long Island City.

Laboratory—By-Products Coke Corp., 112th St. and Torrence Ave., Chicago, Ill., awarded masonry contract for a 3 story, 33 x 65 ft. laboratory at 11153 Torrence Ave. Estimated cost $40,000.

Laboratory (Central Engineering) — Westinghouse Electric & Mfg. Co., E. M. Herr, Pres., East Pittsburgh, Pa., awarded contract for the construction of an 11 story central engineering laboratory to Mellon Stuart Co., Oliver Bldg., Pittsburgh, Pa. Estimated cost $300,000.

Laboratory (Chemical) — Sandoz Chemical Works, 63 Vandam St., New York, N. Y., will build addition to laboratory. Work will be done by day labor.

Laboratory (Chemistry)—University of Texas, c/o J. W. Calhoun, Comptroller, Austin, Tex., awarded contract for the construction of a 4 story, 95 x 308 ft. chemistry building on University Campus to J. E. Morgan, El Paso. Estimated cost $1,000,000. Contract for equipment awarded.

Laboratories (Chemistry and Physics)—Bd. of Education, V. Lauriston, Chn., Chatham, Ont., is having plans prepared and will take bids early in 1930 for the construction of a college building including chemistry and physics laboratories. Estimated cost $250,000. G. R. Gouinlock, 371 Bay St., Toronto, is architect. Complete equipment will be required.

Laboratory (Glass Experimental)—Hartford Empire Co., Homestead Ave., Hartford, Conn., awarded contract for the construction of a 1 story, 73 x 75 ft. glass experimental laboratory to A. F. Peaslee Inc., 15 Lewis St., Hartford. Estimated cost $40,000.

Laboratory (Research) — Imperial Oil Ltd., Sarnia, Ont., is having plans prepared for the construction of a 3 story, 100 x 100 ft. research laboratory. Estimated cost $100,000. C. C. Woods, Imperial Bldg., Sarnia, is architect. Foundations to be started immediately under the supervision of C. Leaver, manager. Interested in prices complete equipment

Leather Factory Addition — Agoos Leather Co., 146 Boston St., Lynn, Mass., awarded contract for the construction of a 2 story, 50 x 210 ft. addition to leather factory at Salem, to E. H. Porter Construction Co., 15 Willis St., Peabody. Estimated cost $40,000.

Leather Products Factory—Michigan Leather Packing Co., 548 East Fort St., Detroit, Mich., plans the construction of a 1 story, 75 x 310 ft. leather products factory on Freeland Ave. Estimated cost $60,000. Private plans. Machinery and equipment will be required.

Limestone Quarry—Stock Co., c/o Chamber of Commerce, Paint Rock, Tex., is being formed to develop a limestone quarry near Paint Rock. Engineers making preliminary surveys, report 15,000,000 cu.yds. stone readily available. Plant will be electrically operated. Estimated cost $100,000.

Oxygen Plant—Burdett Oxygen Co. of Cleveland, W. H. Loveman, Mgr., 3300 Lakeside Ave., Cleveland, O., plans a 2 story addition to plant. Estimated cost $100,000. Private plans.

Prest-O-Lite Plant—Prest-O-Lite Co., 30 East 42nd St., New York, N. Y., is having plans prepared for the construction of a 1 story, 55 x 134 ft. plant at Jacksonville, Fla. Estimated cost $45,000. Private plans.

Newsprint Plant—Maine Seaboard Paper Co., W. S. Wyman, Pres., Augusta, Me., awarded contract for the construction of a plant for the manufacture of newsprint to include railroad sidings, water supply, dredging and dock construction, two paper machines, each 228 in. wide, etc., at Bucksport to Morton C. Tuttle Co., Park Sq. Bldg., Boston, Mass. Estimated cost approximately $10,000,000. Mill will use electric power from new Wyman dam now under construction.

Paper Mill Addition—Northwest Paper Co., H. S. Hornby, Pres., Cloquet, Minn., is having plans prepared for a 2 story, 50 x 350 ft. addition to paper mill including paper machine, vats, beaters, etc. Jacobson Engineering Co., 904 Plymouth Bldg., Minneapolis, is engineer.

Paper Mill—Rising Paper Co., Housatonic, Mass., plans the construction of a 2 story paper mill. Estimated cost $50,000. L. Howes, c/o owner, is architect. Maturity in spring.

Paper Mill—Westminster Paper Co. Ltd, New Westminster, B. C., awarded contract for the construction of a 2 and 3 story paper mill including 68 x 226 ft. machine room, 90 x 168 ft. finishing room, for the manufacture of tissue, and tissue wrappers etc. on Fraser River to Dominion Construction Co. Ltd., 509 Richards St., Vancouver. Estimated cost $150,000. Old machinery to be reconditioned and new machinery to be purchased.

Paper Products Factory—Gulf Paper Products Co., c/o W. L. Morgan, Pres., Beaumont, Tex., plans the construction of a paper products factory.

Paper Products Factory — Paper Products Mfg. Co., East Michigan Ave., Kalamazoo, Mich., awarded contract for a 3 story, 70 x 125, 40 x 42 and 50 x 80 ft. paper products factory on Water St. to Vosler & Deloff, 250 East Kalamazoo Ave., Kalamazoo. Estimated cost $130,000.

Pottery Plant — Fulper Pottery Co., G. K. Large, Pres., Flemington, N. J., will build new pottery plant to replace fire loss. Estimated cost $50,000.

Factory—Continental Diamond Fibre Co., 919 North Michigan Ave., Chicago, Ill., awarded contract for masonry, etc. for a 1 story, 36 x 40 ft. factory for the manufacture of radio sockets, bakelite and fibre sheets, rods, tubes, etc. at 2116-30 North Racine Ave. Estimated cost $28,000.

Radio, etc., Factory—American Bosch Magneto Corp., North Main St., Springfield, Mass., plans large addition to plant for the manufacture of radio sets and automotive equipment to include departments for heat-treating and scrap reclamation, also additional storage and shipping facilities.

Refinery (Oil)—Bell Oil & Gas Co., Kennedy Bldg., Tulsa, Okla., is having preliminary plans prepared for the construction of an oil refinery, 5000 bbl. capacity at Pampa, Tex. Private plans.

Refinery (Oil)—Bloomfield Oil & Gas Corp., Carlsban, New Mex., acquired oil refinery plant and plans extensions and improvements at Nacogdoches, Tex. Estimated cost $25,000. Machinery and equipment will be required.

Refinery (Oil)—Fox & Foster, Buston, Okla., is having preliminary plans prepared for rebuilding and enlarging oil refinery at Guthrie. Estimated cost $30,000. Private plans.

Refinery (Oil)—W. F. Nye, Fish Island, New Bedford, Mass., awarded contract for the construction of a 1 story, 80 x 165 ft. oil refinery at Coggeshall and River Sts., Fairhaven, to A. E. Wing, 51 Williams St., Fairhaven. Estimated cost $45,000.

Refinery (Lubricating Oil)—Rio Grande Oil Co., 525 East 7th St., El Paso, Tex., plans the construction of a lubricating oil refinery, 3,000 bbl. daily capacity. Estimated cost $1,800,000. Private plans. Work will probably be done by day labor and may purchase machinery and equipment.

Retort Building — Vicking Oil Co., G. H. Seager, Clarendon, Pa., awarded contract for the construction of a 1 story, 46 x 66 ft. retort building to Rodgers Structural Steel Co., Corry, Pa.

Electric Smelter—Georgetown Foundry Co., Georgetown, Ont., interested in prices on electric smelter.

Smelter and Refinery—American Smelting and Refining Co., Maurer St., Perth Amboy, N. J., will build a 1 story, 70 x 140 ft. addition to plant on State St. Estimated cost $40,000. Private plans. Work will be done by separate contracts.

Refractories Plant—J. H. France Refractories Co., J. H. France, in charge, Snow Shoe, Pa., will soon award contract for the construction of a refractories plant including, 100 x 460 ft. kiln building, 20 x 60 ft. press building, 60 x 80 ft. bin storage buildings, 30 x 30 ft. mixer room, 400 ft. continuous kiln, 300 ft. dryer and refractories equipment at Falls Creek. Estimated cost $350,000. Private plans.

Rubber Sundries Factory — Tuscon Tire & Rubber Co., Carrollton, O., plans the construction of a 1 story, 40 x 180 ft. factory for the manufacture of rubber sundries. Estimated cost $40,000. Private plans.

Rubber Factory—U. S. Rubber Co., 211 Passaic St., Passaic, N. J., awarded contract for the construction of a 6 story, 100 x 175 ft. rubber factory (building No. 25) on Market St. to Turner Construction Co., 420 Lexington Ave., New York, N. Y. Estimated cost $400,000.

Shoe Vulcanizing Building — Wood Rubber Co., 98 Nichols Ave., Watertown, Mass., awarded contract for a 2 story, 35 x 65 ft. shoe vulcanizing building to Tredennick-Billings Co., 10 High St., Boston. Estimated cost $40,000 to $50,000.

Tire and Rubber Factory Annex—Goodrich Tire & Rubber Co., East 9th St., Los Angeles, Calif., plans the construction of an annex to factory. Estimated cost $250,000. Work will not start before June of next year.

Tile and Fireproofing Factory—A. C. Diller, Orrville, O., plans the construction of a factory for the manufacture of tile and fireproofing to replace fire loss. Estimated cost $40,000. Private plans.

Tobacco Processing Plant and Warehouse—Imperial Tobacco Co., 3810 St. Antoine St., Montreal, Que., awarded contract for the construction of a tobacco processing plant including 100 x 300 ft. boiler house, 100 x 330 ft. storage building, etc. at Delhi, Ont. to G. H. Emery Construction Co., Dowler Bldg., Windsor, Ont. Complete tobacco processing equipment will be installed.

Varnish Wax Factory—S. E. Johnston Co., L. Croft, Mgr., Webster St., Brantford, Ont., plans addition to varnish wax factory including equipment. Estimated cost $50,000.

Wax Paper Factory — Cleveland Wax Paper Co., H. L. Fredrichs, Pres., 2217 Scranton Rd., Cleveland, O., awarded contract for a 1 story, 90 x 120 ft. factory at Berea and Triskett Rds. to S. W. Emerson Co., 1836 Euclid Ave., Cleveland. Estimated cost $50,000.

Welding Shop—Scott Welded Products Co., Van Alst Ave. and Harris St., Long Island City, N. Y., awarded contract for the construction of a welding shop to Bonafide Building Co., 276 Jackson Ave., Long Island City.

Sintering Plant—Buffalo Sintering Corp., Marilla, N. Y., awarded contract for addition to plant to J. W. Cowper & Co. Inc., M. & T. Bldg., Buffalo. Estimated cost $175,000.

Sintering Plant—Illinois Steel Co., 208 South La Salle St., Chicago, Ill., has work under way on the construction of a sintering plant at Joliet to reclaim particles of iron from flue dust. Estimated cost $300,000.

Iron and Steel Plant—South African Iron & Steel Industrial Corp., Ltd., 82 Marshall St., Johannesburg, South Africa and office of High Commissioner for Union of South Africa, South Africa House, Trafalgar Sq., London, W. C. 2, England, will receive bids until April 12 for a complete iron and steel plant and equipment at Pretoria. The plant will consist of by-product coke ovens, two blast furnaces, open hearth steel plant and rolling mills, complete with power house and all accessory departments. Initial production of 200,000 tons per year, but is laid out so that the output can easily be increased.

The specifications will be available at the office of the National Bank of South Africa, 44 Beaver St., New York.

Consulting engineers are The International Construction Co., 56 Kingsway, London, W. C. 2.

Galvanizing Plant—Canadian Steel Corp. Ltd., W. R. Perley, Pres., Ojibway, Ont., plans to erect and equip a plant for galvanizing black sheets, also power house in connection with proposed tin plate mill. Estimated cost $500,000.

Steel Foundry Addition—Chapman Valve Mfg. Co., Indian Orchard, Mass., plans a 75 x 152 ft. addition to steel foundry. Will install new core, mold-drying and annealing ovens for use of oil in place of electricity in present steel foundry.

Tube Mills, Open Hearth Mill and Bar Mill—National Tube Co., subsidiary of U. S. Steel Co., 71 Broadway, New York, G. G. Goe, Frick Bldg., Pittsburgh, Pa., Local Purch. Agt., awarded contract for two seamless tube mills, one open hearth mill and one bar mill at McKeesport, Pa. Estimated cost $20,000,000. Work under way on foundations and erecting steel.

Sugar Mill—Southern Sugar Co., B. G. Dahlberg, Pres., 919 North Michigan Ave., Chicago, Ill., negotiating for site 10,000 acres at Canal Point, Fla., if successful will construct a sugar mill, 5,000 ton capacity. Estimated cost $9,000,000.

ROTEX
COMPACT SCREENS

Adaptable and Dependable

Leaders in every industry have adopted ROTEX Screens as their standard equipment for all screening operations. This, as well as the following facts, proves the ROTEX worthy of the broad description "adaptable and dependable."

The nearly level gyratory motion of the screen box, combined with the action of the "ball-and-bevel-strip" mesh cleaning system, produce a screening action that is basically correct.

This enables the ROTEX to handle large capacities on all kinds of work and produce economical and accurate separations.

The mesh cleaning system keeps the entire screen surface clean and working at all times thus entirely eliminating costly periodic hand cleaning.

The construction of the ROTEX is rugged, insuring years of service free from mechanical troubles. At the same time, all parts are readily accessible for screen changes, lubrication and similar attentions.

Consider ROTEX Screens for your work, submit samples, and allow our engineers to show you the results ROTEX will produce with your materials.

The ORVILLE SIMPSON COMPANY

Office and Factory
1252 KNOWLTON ST.
CINCINNATI, OHIO

THIS fellow, with sweating brow and straining back is not at fault. True, he is wasting millions for American Industry. But back of a desk somewhere is the man who *is* to blame.

Put a hoist control in this laborer's hands instead of a box, a casting or a shovel. Let the same two hands and a C-M Hoist release five of his fellows for more profitable labor.

Bunk! No. It's a fact! Take your pen and invite a Chisholm-Moore Engineer to prove it in your own plant without cost or obligation to you.

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STILLSON

With the new red handle and the same old trademark...

The Genuine Master Stillson with steel or wood handles in 6, 8, 10 and 14-inch sizes and with steel handles only in 18, 24, 36 and 48-inch sizes.

You can pick out a genuine Walworth Master Stillson from a whole pile of others by its bright red handle.

You can further satisfy yourself that it's the real thing by the little old diamond with the word STILLSON drop forged on the top jaw.

And when your men get to working with the Master Stillson, they will quickly sense its greater strength in the way its harder teeth and heat-toughened jaw and bar stand up under the strain of doing the day's work.

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Walworth Company, General Sales Offices: 51 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.

Distributors in Principal Cities of the World

Walworth Company Limited, 620 Cathcart St., Montreal, P. Q.
Walworth International Co., 11 Broadway, New York, Foreign Representative

"An Utter Stranger

bought this Rolls Royce for me . . . by reducing my drying costs!"

"So you think I've been spreading myself, eh? As a matter of fact, a stranger bought this car for me . . . and he'll buy me another one just like it every year.

"Here's what happened! Two years ago a man who called himself a Louisville Drying Engineer dropped in to see me. Said he felt confident he could cut my drying costs and asked permission to analyze my methods.

"Well, I turned him loose in the factory and proceeded to forget all about him. But two or three weeks later he reappeared with a lengthy report that certainly made me sit up and take notice.

"He proved, for example, that one man could do the work of the four we then employed in our drying department. He also proved that we were using 45% more fuel and 80% more floor space than was necessary.

"I didn't dare let him see how impressed I was, so I began questioning him about the responsibility of his firm. There he floored me again, for I found that it had been in business forty years and had satisfied more than a thousand manufacturers in fifty different industries.

"To make a long story short, we bought a Louisville Rotary Dryer and it paid for itself the first year. I bought this car with last year's savings, so you see I haven't been spreading myself after all.

"Honestly, Dick, you ought to have a talk with a Louisville Drying Engineer. They make no charge for consultation and even if they prove your equipment inefficient you'll be under no obligation to replace it. Hop in, old man, and I'll take you for a ride."

5 Ways

to cut drying costs

1 The first way is to permit Louisville Drying Engineers to make a study of your drying problems. They will recommend a Louisville Dryer which will

2 Cut fuel expense from one-third to one-half in many cases.

3 Deliver dried material *continuously*, thus permitting of uninterrupted plant operation.

4 Cut the number of attendants needed to one in most instances.

5 Reduce the amount of floor space required as much as 80%.

LOUISVILLE
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Rubber
Soap
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Sugar
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Leather
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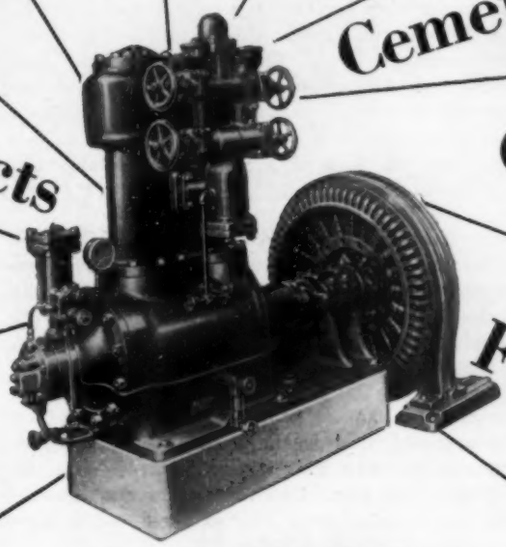
Fertilizers



YORK

REFRIGERATION MEETS THE INDIVIDUAL REQUIREMENTS OF ALL THESE INDUSTRIES

York Refrigerating Machines have a place in every process and operation where accurately controlled and dependable *cold* is required.

York Ice Machinery is the product of the largest plant of its kind backed by the experience and research of the world's foremost refrigerating engineers. This means exclusive features and advantages which insure economies to the user.

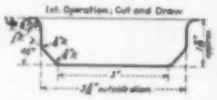
Let us submit an economical plan of York Refrigeration for *your* process. Write.

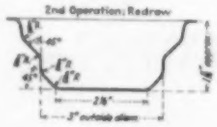
YORK ICE MACHINERY CORPORATION

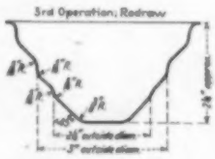
GENERAL OFFICES, YORK, PENNSYLVANIA

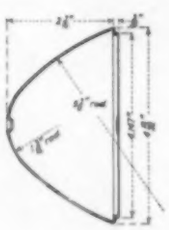
RUSTLESS IRON

Deep Drawing









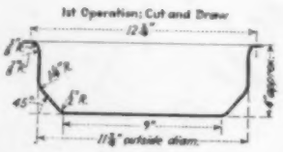
THE technique of deep drawing Chrome Iron Alloys containing high percentages of Chromium is quite different from the present practice of drawing steel, copper, brass or other metals. Judging by the physical properties as found in standard tensile tests such alloys seem to be very similar to certain ordinary steels. Their behavior in deep drawing is not alike, however, due to certain special features with which these Chrome Iron Alloys confront us and which unfortunately are not generally known by the design engineers in the plant. There is no literature available on this subject and the lack of a reliable drawability test makes it still more difficult.

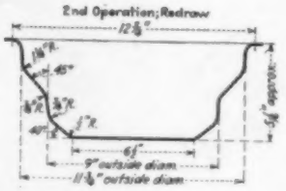
It is necessary to avoid overstraining these alloys in any forming operation, especially if further deformation takes place in following operations. In carefully calculating the different steps, material with up to 20% Chromium content can be drawn into any shape with oftentimes less breakage than other materials.

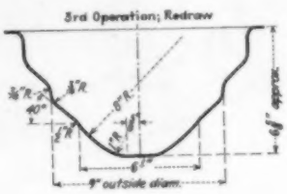
The tool steel has to be properly selected, and oil hardening alloy steels should be used where mass production is desired. This will eliminate frequent refinishing of the dies. Cast iron works also satisfactorily and in some cases very excellent results have been obtained with bronze dies.

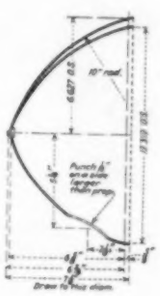
The lubrication is of greatest importance and will be dealt with in an early issue.

The drawings show the dimensions of actual layouts which are made by the development division of the Rustless Iron Corporation of America.









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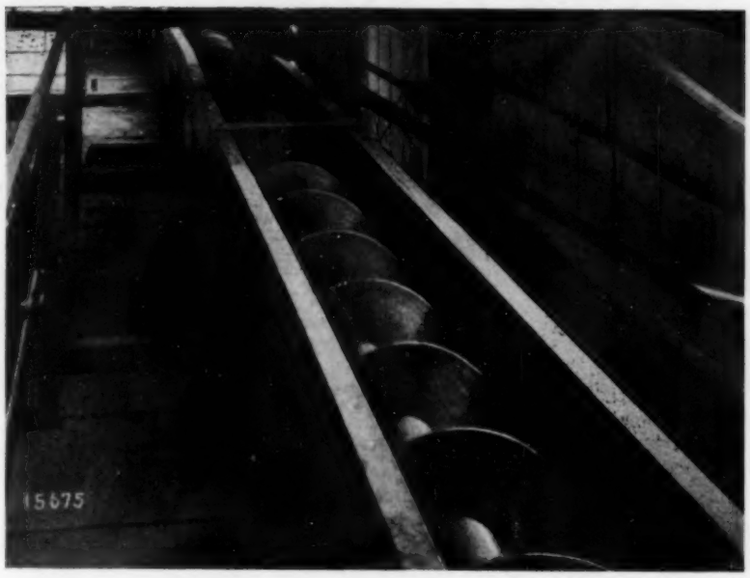
Where Space Is Limited



Use Jeffrey Lock Grip Spirals

Where conditions do not permit the use of a return conveyor such as under floors, through roof trusses, or over bins, or where it is necessary to have a dust tight conveyor Jeffrey Spirals are especially desirable for handling bulk materials 4 inches and under.

Jeffrey spiral flights fit the pipe with a lock grip that practically relieves the end lugs of strain.

The steel troughs are virtually rigid steel girders and require little support, making the spiral a comparatively easy and inexpensive conveyor to install.

Conveyors over twenty-five feet long in steel boxes have renewable thrust collars, two steel collars alternated with two bronze collars.

The discharge of material may be by either plain slide or rack-and-pinion valves. Either type can be assembled so that the sliding plates operate in any one of four directions. The discharge spouts are welded to the trough. Being practically free from breakage, the steel plate construction of these spouts and valves represents a distinct improvement over the older cast iron types. Catalog 398-V gives complete specifications for Jeffrey Spirals. May we send you a copy?

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Jeffrey Manufacturing Company, Ltd. of Canada
Head Office, Montreal. Branch Office, Toronto

JEFFREY PORTABLE UNITS for Stacking, Loading and Unloading Bulk and Package Materials

PORTABLE BAG STACKER

Handles, bags, boxes, and packages weighing up to 325 lbs. to a height of 30 ft. Boom adjustable to height of stack.

PORTABLE DRAG-ON CONVEYOR

Unloads coal from railroad cars to trucks or storage, or reclaims from storage. Capacity — one ton per minute.

24" PORTABLE BELT CONVEYOR

Sand, crushed stone, coal and similar materials are easily handled from ground storage or from hopper bottom cars.

X-TRACK-TOR CAR UNLOADER

Unloads coal from hopper bottom cars. Operates above or below rails.

The portable conveyors shown above together with other Jeffrey portable units for handling bulk materials are completely illustrated in Bulletin No. 474-G.

Jeffrey Portables for package materials are described in Bulletin No. 481-B.

Copies of these bulletins will be mailed on request.

JEFFREY
MATERIAL HANDLING EQUIPMENT

JEFFREY PRODUCTS

- Elevators—Conveyors
- Portable Loaders
- Coal and Ashes Handling Equipment
- Skip Hoists
- Chains and Attachments
- Sprocket Wheels—Gears
- Crushers—Pulverizers
- Sand and Gravel Handling, Washing and Screening Equipment
- Locomotives
- Mine Equipment
- Ventilation Fans

A NEW DESIGN

BOX-HEADER BOILER

The new C-E Single-Seam Box-Header Boiler is a distinct advance in construction and design over ordinary box header practice.

In the new design —

The wrapper or butt strap joining the tube and hand hole sheets is —ELIMINATED.

ONE ROW OF RIVETS JOINS THE TUBE SHEET DIRECTLY TO THE HAND HOLE SHEET.

The row of rivets on the tube side of the wrapper strap is —ELIMINATED.

THERE IS ONLY ONE CAULKING EDGE and this faces the outside — making inspection easy and removing all rivets out of the hot gas and fire zones.

Three thicknesses of metal at the caulking joint at the ears are — REDUCED TO TWO THICKNESSES.

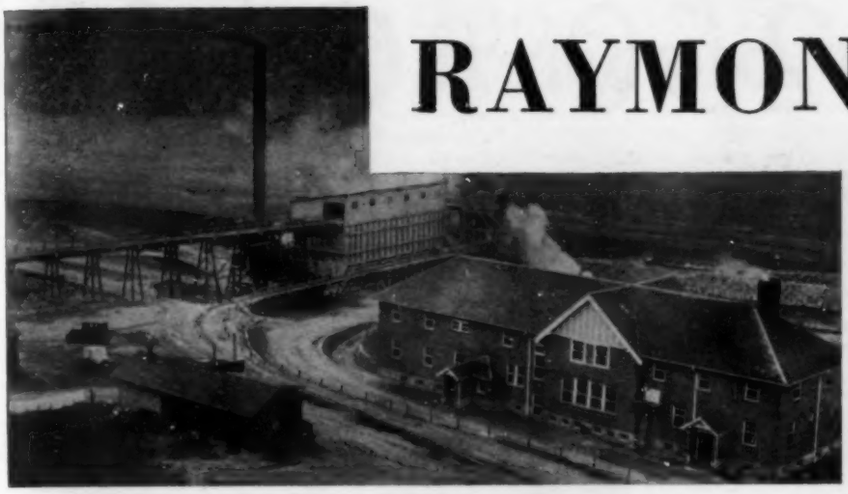
This new design provides an unusual factor of safety. For instance, in the standard unit sold for 160 lb. to 250 lb. working pressure, the header joint is adequate for a working pressure of 450 lb.

A careful inspection of this new boiler will convince you that the C-E Box-Header Boiler is a better Box-Header Boiler.

COMBUSTION ENGINEERING CORPORATION

International Combustion Building
200 Madison Avenue, New York

A Subsidiary of
International Combustion Engineering Corporation



RAYMOND MILLS

grind the lime for the Steffens Process used in the Beet Sugar Industry.....

Raymond Mills are extensively used for pulverizing caustic lime for use in the Beet Sugar Industry. Likewise they are equally as successful in many other processes and industries in reducing grinding costs and producing a powder of uniform fineness.

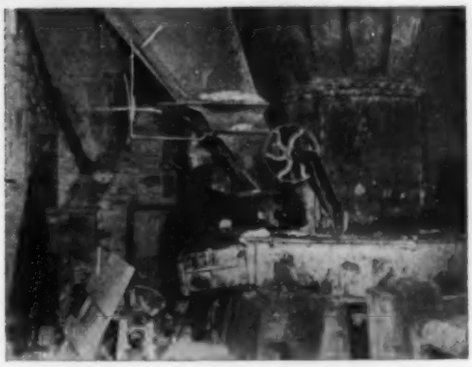
The ability of the Raymond Kiln Mill to dry and grind in one operation has been the source of large savings to many companies. The advantages of this newer method of pulverizing are many.

It dispenses with separate dryer equipment and auxiliary conveyors. It saves on space, requires less labor and supervision, reduces power consumption and upkeep, lessens material handling costs, and reduces the amount of capital investment.

Besides reducing the cost of the finished products this improved method of pulverizing and drying in one operation assures a product of uniformly high quality.

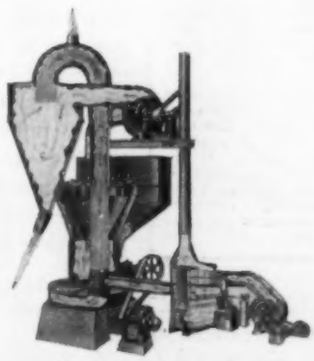
The advantages of Raymond Pulverizing equipment are so far-reaching that they deserve careful consideration wherever a product has to be pulverized.

Raymond Engineers have a remarkably successful record for reducing pulverizing costs. There is no obligation involved on your part in asking them to assist you with your pulverizing problem.



RAYMOND HIGH SIDE MILLS

Raymond Mills installed for pulverizing caustic lime for use in making beet sugar.



RAYMOND KILN MILL

The Raymond Mill that combines two operations in one by drying and grinding simultaneously.

RAYMOND BROS. IMPACT PULVERIZER CO.

Subsidiary of International Combustion Engineering Corporation

Main Office and Works: 1311 North Branch Street, Chicago, Illinois

342 Madison Ave.
New York

Guardian Bldg.
Cleveland

Subway Terminal Bldg.
Los Angeles

WIN $250.00 CASH

18 Other Cash Prizes, Too! Total $500.00

WRITE A SIMPLE SLOGAN

This offer is open to every reader of this announcement. It makes no difference who you are or where you live. We want a new slogan for Nordstrom Valves. Whoever sends the best slogan will win $250.00. If you don't win the big cash prize, there are 18 other cash awards—any one of which may go to you.

"Won't Stick—Won't Leak" has been our slogan for years. But now we want something new—a slogan that will express in a few words the advantages of Nordstrom Valves. A brief synopsis of these advantages is given in this advertisement. Read it carefully. Or send for literature which may help you to submit the winning slogan.

Any slogan may win. No matter how simple your slogan may sound to you—send it in. You cannot afford to neglect this big opportunity to win one of the generous cash prizes offered. Remember—there is no obligation! The persons submitting the winning slogans will have nothing else to do. We have nothing to sell in this contest. Get busy with your slogans at once. A little time—a little thought—may win for you. Contest closes December 31st. Only a short time left!

CASH AWARDS	
First Prize -	$250.00
Second Prize -	100.00
Third Prize -	50.00
4 Prizes, each -	10.00
12 Prizes, each -	5.00
TOTAL 19 Cash Prizes	$500.00

Rules of Contest

Anyone is eligible except employees of Merco Nordstrom Valve Company or affiliated companies. Slogan must not exceed 10 words. Any number of slogans may be submitted by same person. Use coupon below or separate sheet of paper. If two or more contestants tie for any prize, each contestant will receive the full amount of the prize tied for.

MAIL THIS ENTRY BLANK

MERCO NORDSTROM VALVE CO.,
343 Sansome St., San Francisco, Calif.

I submit the following slogan(s) pertaining to Nordstrom Valves:

_____

_____

_____

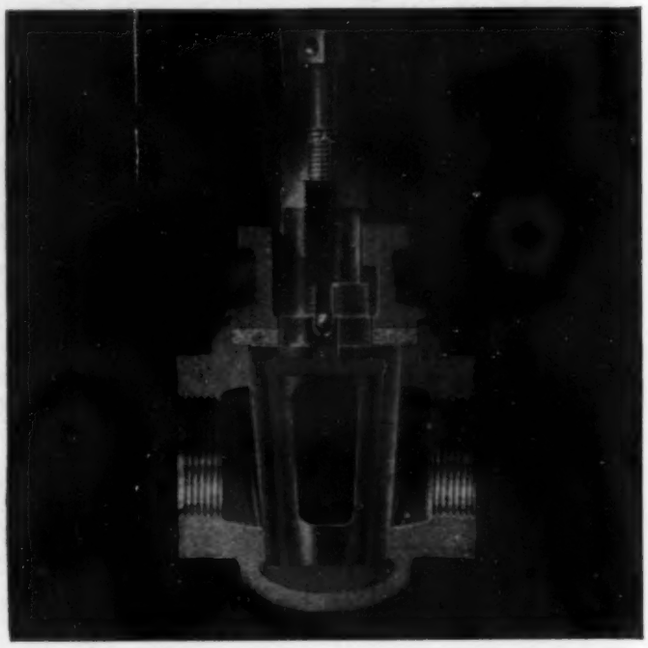
_____

Name _____

Address _____

City _____ State _____

(Use separate sheet if not sufficient room)



NORDSTROM VALVES *(lubricated)*

Stop Leaks
Prevent Sticking
Plug always easy to Turn

Nordstrom Valves are of the plug cock type, with lubrication and lifting features that make them easy and sure of operation. A stick of special "Merco" Lubricant is inserted under the lubricant screw. The latter, when turned, forces the lubricant down and around the plug. Fluid or other material within the line cannot pass around the plug and leak out, or lodge in the seat. The plug is always easy to turn. Made in types and sizes to meet conditions in all industries.

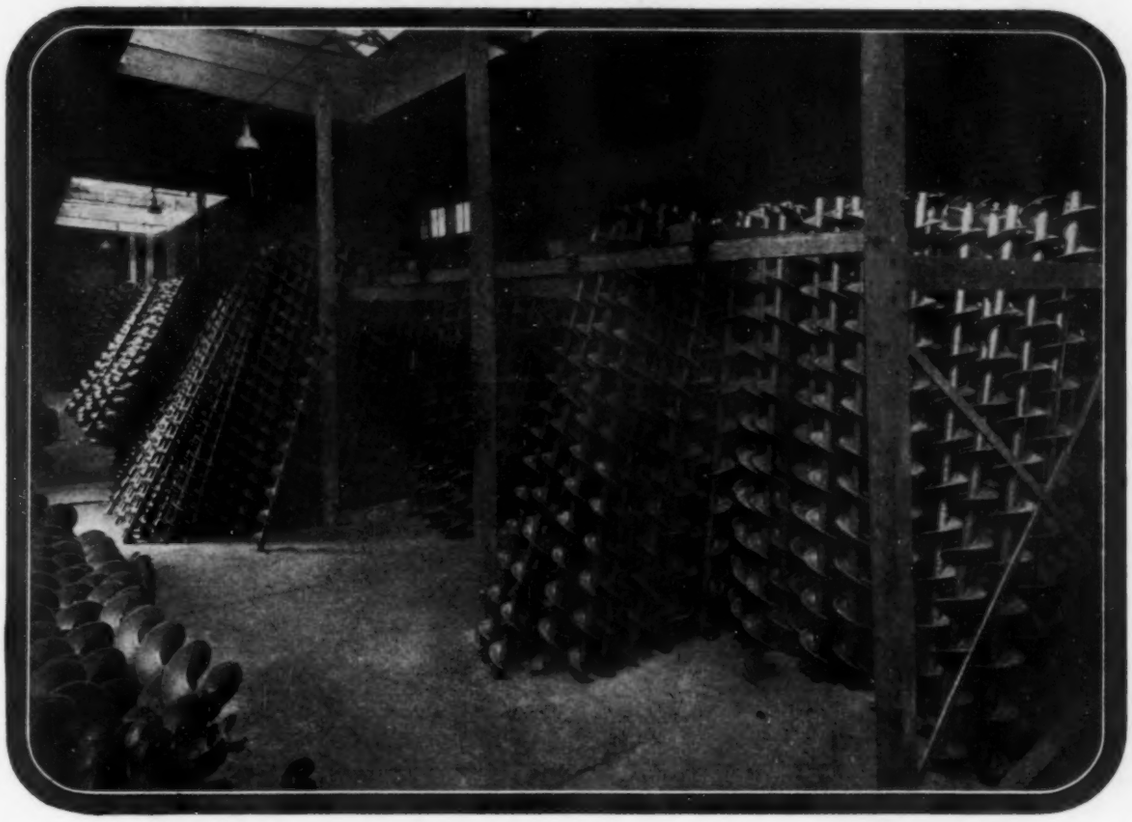
Ask for Literature

Merco Nordstrom Valve Co.
SUBSIDIARY OF THE MERRILL COMPANY
Engineers - Manufacturers

Atlanta: Healey Bldg.
Boston: 184 Boylston St.
Buffalo: Genesee Bldg.
Chicago: 176 W. Adams St.
Dallas: Magnolia Bldg.
Detroit: 2842 W. Grand Blvd.
El Paso: 111 S. Virginia St.
Houston: Petroleum Bldg.
Los Angeles: 556 S. San Pedro St.
New Orleans: Masonic Temple Bldg.
New York: 11 W. 42nd St.
Pittsburgh: Clark Bldg.
Portland: Buyers Bldg.
San Francisco: 343 Sansome St.

AGENCIES IN PRINCIPAL CITIES
Factories—Oakland, California, and Belleville, New Jersey
Canadian Manufacturers:
Peacock Bros., Ltd., Montreal, Cobalt, Winnipeg, Vancouver.
England: Audley Engineering Co., Ltd., Newport, Shropshire.
Buenos Aires, Argentine:
General Electric, Soc. Anon., Victoria 618 Esq. Peru.

Original Helicoid Conveyor



"HELICOID" means Caldwell Helicoid

Be sure you get the original Caldwell Helicoid, made by the originators of the spiral or screw conveyor. You can identify genuine Caldwell by the name "Caldwell" on every standard length.

Helicoid is rolled from a single strip of metal with no laps or rivets to interfere with the normal, easy flow of materials.

It is strong, durable, long-lived and easier to clean.

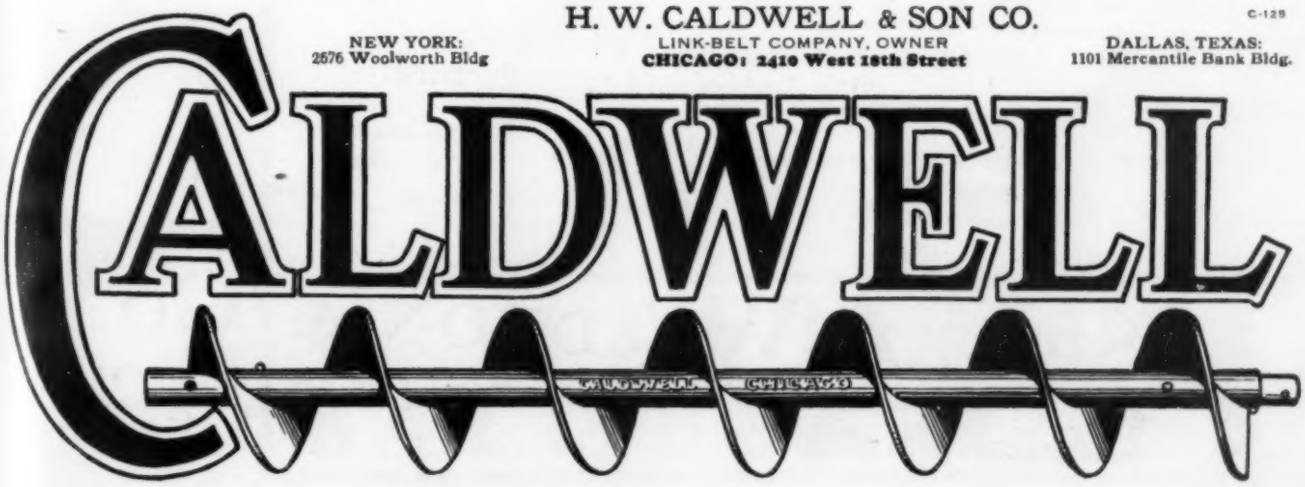
We manufacture both the Helicoid and Sectional Flight conveyors.

H. W. CALDWELL & SON CO. C-125

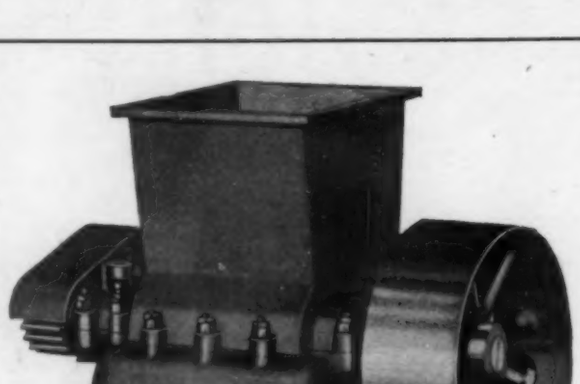
NEW YORK: 2576 Woolworth Bldg

LINK-BELT COMPANY, OWNER
CHICAGO: 2410 West 18th Street

DALLAS, TEXAS: 1101 Mercantile Bank Bldg.



In what part of production do you use **crushing?**



MONARCH SAW TOOTH CRUSHERS

At the beginning? . . .

In the reducing of raw material to workable sizes Monarch Crushers are built in exceptionally heavy types to give large capacity and withstand the roughest usage. Such extra-heavy construction eliminates vibration, minimizes maintenance and assures positive and continuous crushing service.

At the end? . . .

Where uniformity is the uppermost factor. Granulation and grinding with Monarchs assures that homogeneousness of product necessary to the fostering of good will among customers and the realization of profits.

Write for catalog CD.

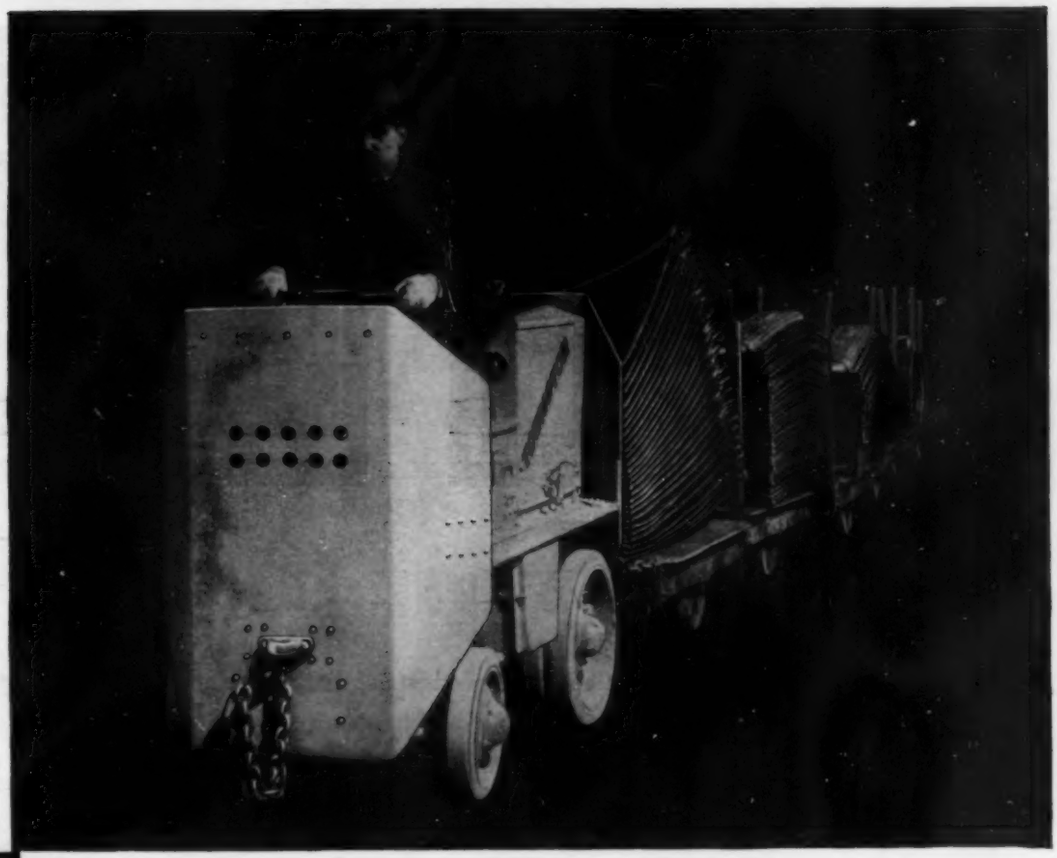
We design and manufacture:

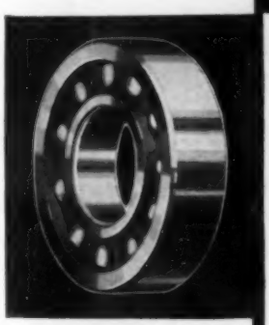
Attrition Mills	Mixers	Elevators
Roller Mills	Reels	Conveyors
Burr Mills	Sifters	Power Transmission

SPROUT-WALDRON & CO.

Designers—Engineers—Manufacturers of Process Equipment

20-28 WALDRON STREET MUNCY, PENNA.





THE efficient transmission of power from a sturdy engine to a long line of loaded trailers depends largely on the type of bearings used. In designing their transmission, Towmotor engineers avoided power losses so far as possible by installing six New Departure Ball Bearings. ¶ In these bearings strong alloy steels endure the knocks and shocks of rough usage — wear-free design insures permanently maintained rigidity of shafts and gears, without ever need of adjustments throughout their long life. ¶ The New Departure Mfg. Company, Bristol, Conn.

o o o **NOTHING ROLLS LIKE A BALL**

1445

NEW DEPARTURE BALL BEARINGS

How you benefit

THE qualities of Yale Electric Industrial Trucks and Stuebing Hand Lift Trucks and Skid Platforms—have been united to give you a combined service that will meet your particular materials handling problem at the lowest cost.

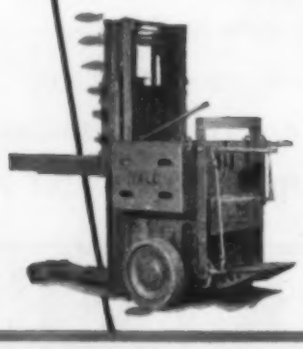
No job is too small—no task too great—to receive the special attention of Yale engineers whose sole aim and effort will continue to provide the best materials handling equipment at prices comparable with the very best materials and workmanship.

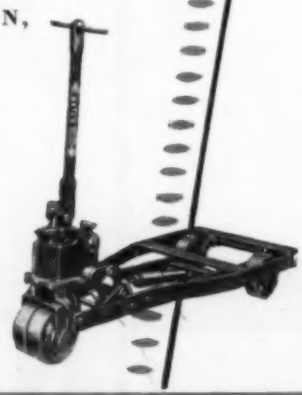
It is easy to select either a Yale Electric Industrial Truck or a Stuebing Hand Lift Truck from the Yale line—it is complete. There are models and types to meet practically every condition.

Let us analyze your materials handling problem and then suggest, without obligation to you, that particular method best suited for you. Write to Dept. K-2.

THE YALE & TOWNE MANUFACTURING COMPANY

Stamford, Connecticut — STUEBING DIVISION, Cincinnati, Ohio.





TRADE YALE MARK

StueBing

RESISTO PRODUCTS

for corrosion control

pumps that keep the pace

in spite of the corrosive ravages of process liquids. Rugged, durable pumps designed to meet the most severe conditions. Solid built of hard lead or lined with rubber, lead or tin. Specify them wherever corrosion is to be considered.

RESISTO PIPE & VALVE CO.

262 Bridge Street, E. Cambridge, Mass.

PIPE · VALVES · PUMPS · FITTINGS · CASTINGS

Complete Manufacturing · Engineering · Installation · Service

4° FAHRENHEIT

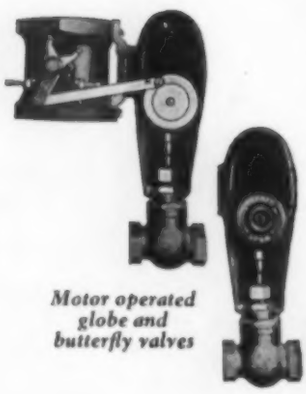
Temperature controller

Not much to talk about when it comes to figures but it may mean the difference between a perfect product and spoilage. It may mean the loss of thousands of dollars in materials and orders and the loss of clients.

You can provide protection against just such losses with Minneapolis-Honeywell Automatic Industrial Controls. They save labor, protect the uniformity of your products and eliminate the errors due to the "human element" factor. Whether it is automatic or remote control of the flow of liquids or gases, or the regulation of temperatures and pressures, it will pay you to investigate Minneapolis-Honeywell Motor Valves and Temperature and Pressure Controllers.

Our engineers will gladly discuss with you your control problems. Send the coupon today.

MINNEAPOLIS
INDUSTRIAL REGULATORS
HONEYWELL



Motor operated globe and butterfly valves

Pressure controller

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

Executive Offices: 2704 Fourth Ave. So., Minneapolis, Minn.

Factories: Minneapolis, Minn. and Wabash, Ind.

Branch Offices: New York, Chicago, Philadelphia, Boston, Detroit, Cleveland, St. Louis, Milwaukee, Pittsburgh, Washington, Buffalo, Syracuse, Rochester, Denver, Los Angeles, San Francisco, Portland, Seattle, Hartford, New Haven.

MINNEAPOLIS-HONEYWELL REGULATOR CO.
2704 Fourth Avenue So., Minneapolis, Minn.

☐ Send me your catalog on Industrial Regulators.
☐ Have representative call. I understand there is no obligation.

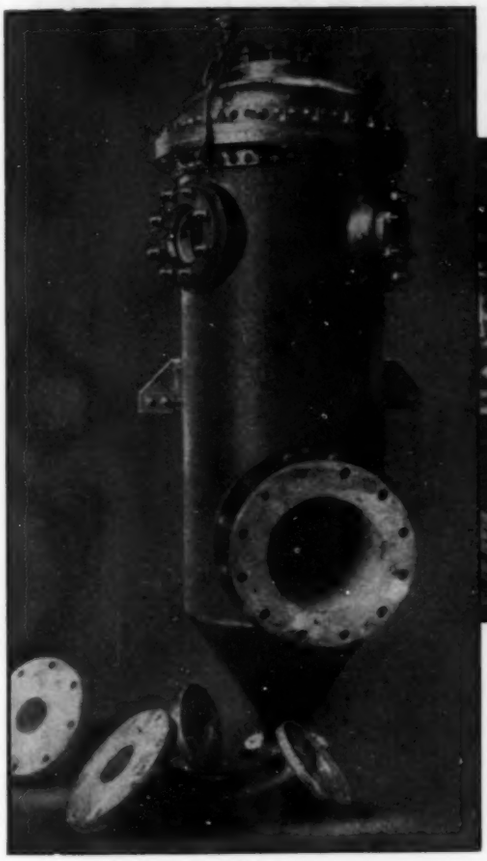
Name..... Position.....

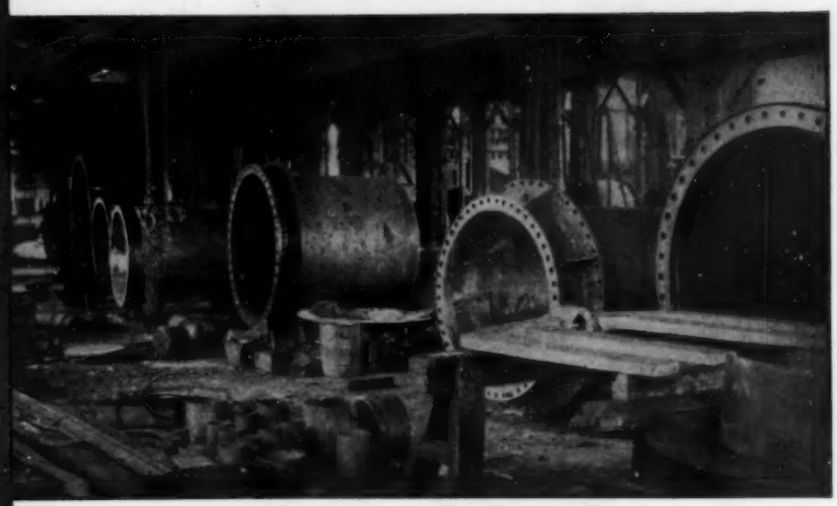
Company.....

Address.....

City..... State.....

HOMOGENEOUS LEAD LINED TANKS





OUR improved process of lead lining makes it possible to line vessels and tanks of all descriptions, with a dense, flawless covering of lead.

Long service is assured. The chemical lead is inseparable from the steel under vacuum pressure and up to within a few degrees of the melting point of the lead itself.

Heat, vacuum, or pressure tests are applied in our shops according to the requirements for which the equipment is built. Apparatus is shipped in first class condition ready for immediate use.

For process or storage, wherever corrosive liquids are handled, Homogeneous Lead Lined Equipment offers unique possibilities. Tell us your problems and let us show you how this equipment can help you.

PARTIAL LIST OF PRODUCTS

made by the Chemical Equipment Mfg. Company:

Vacuum evaporators, vacuum tanks, steam jacketed kettles, acid eggs, car tanks, digesters, autoclaves and agitators.

National Lead Company manufactures and sells the following related line of "United" products:

"United Tubond" chemical lead lined pipe and fittings for handling dilute sulphuric, sulphurous and other acids, mine and salt water, etc. (This equipment can also be tin-lined); chemical lead and tin covered pipe and fittings; hard lead fittings, valves, cocks and pumps.

NATIONAL LEAD COMPANY

111 BROADWAY, NEW YORK, N. Y.

Sole Agents for the Chemical Equipment Mfg. Co.

FOR CORROSION RESISTANCE *PLUS*

7 out of every 10 users
place repeat orders

Lightnin Portable Mixers can be used on any type tank, crock vat, drum or barrel.

Remember also there's no installation cost.

ONE reason for the wide acceptance of Lightnin Portable Mixers is their dependable operation.

The best proof of this comes from users familiar with all the advantages of Lightnin Mixers.

An average of 70% of these users place repeat orders for Lightnin Portable Mixers. In fact some plants now have in operation from 2 to 100 times as many Lightnin Mixers as they originally started with.

Other reasons why Lightnin Portable Mixers are so well and favorably known throughout the process industries are:

They save power costs; adaptable to a wide range of mixing operations; they prove dependable under continuous operation; they can be easily moved from one batch to another saving time and trouble.

Sizes and speeds to meet every mixing need. Write us today for descriptive data.

MIXING EQUIPMENT CO., INC.
1028 GARSON AVE., ROCHESTER, N. Y.
229 East 38th St., New York, N. Y.

LIGHTNIN
PORTABLE
MIXERS

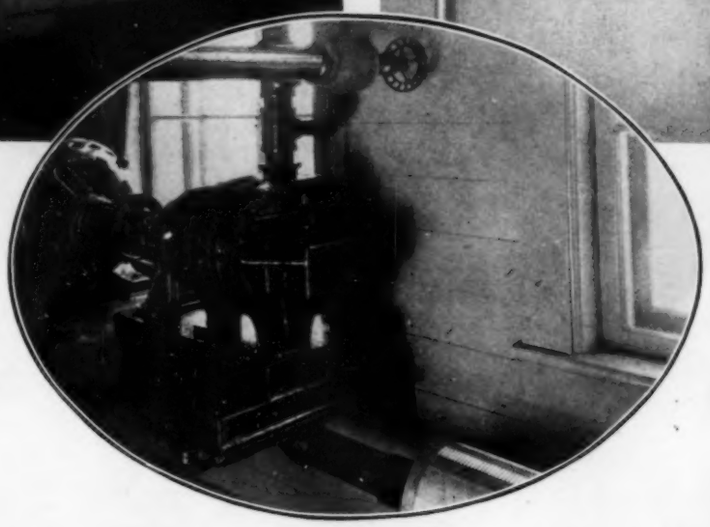
SPECIAL FEATURES

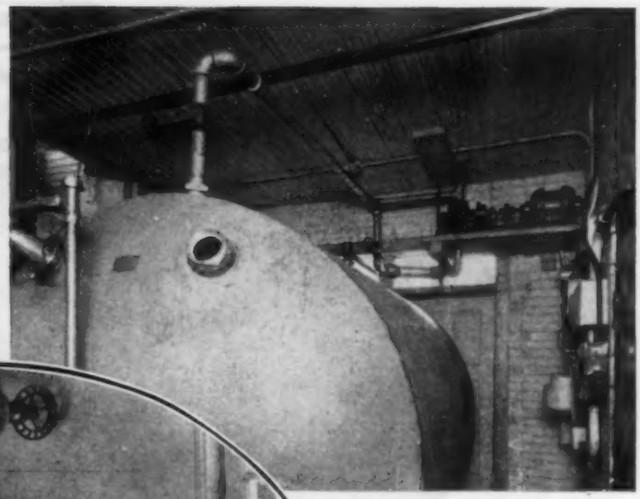
Vertical ball bearing motors.
Outboard ball bearing shaft support.
Universally adjustable clamp.
Telescope shaft.
Single or dual propellers.
Top propeller adjustable.
Propellers thrusting downward.
Totally enclosed, self ventilated.
Motors for inflammable mixtures.
No installation cost.
Can be applied to any style of mixing tank.

ORIGINATORS AND WORLD'S LARGEST BUILDERS OF PORTABLE ELECTRIC MIXERS

Above—This view shows a Connersville Blower used to unload milk from tank trucks to the storage tanks of the United Dairy Company at Chicago.

Right — A Connersville Blower in use at the plant of the Dairymen's League Cooperative Association of New York at West Chazy, New York.





Above — A Connersville Blower in use at the Koenig Dairy Company to unload the tank trucks and also move the milk from the storage tanks to their pasteurization system.

Rapid and sanitary handling of liquids by positive air pressure

Are there liquids to be moved at your plant through moderate heads? Must cleanliness and sanitation be a first consideration? Then you will be interested in the service which Connersville Blowers are giving in this field.

The liquids will come in contact only with your tanks and piping and the air from the Connersville Blower. This air is free from oil, moisture or other impurities since Connersville Blowers do not require internal lubrication or sealing.

Rapid movement of the liquids is caused by the positive air delivery of Connersville Blowers. Used extensively in the dairy industry for loading and unloading tank cars and trucks, or moving the milk from storage tanks through the pasteurization process. Connersville Blowers are also applied to the handling of syrups, acids, and other liquids.

The same positive and cleanly air characteristics have caused the wide use of Connersville Blowers for the aeration of liquids in ice plants and food product plants.

Send for literature and information which will help you plan the adoption of these modern methods for handling liquids.

THE CONNERSVILLE BLOWER COMPANY, INC.

Columbia Ave. at 12th St., Connersville, Indiana

53 W. Jackson Blvd.
Chicago

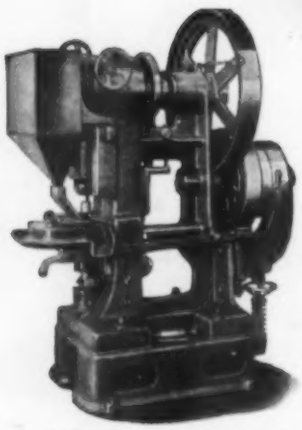
Chamber of Commerce Bldg.
Pittsburgh

114 Liberty St.
New York

CONNERSVILLE

Blowers • Gas Pumps • Meters • Cycloidal Pumps

in the
SPOTLIGHT!



STOKES Standard Automatic Press – model "R" – equipped with Automatic Pressure Release

One Saving of $3750.00 per day with Stokes Equipment.....

Another Saving of $12,000.00 in three months - the entire cost of the installation.

Applied to YOUR problem our 34 years' experience in designing and building the equipment listed should result in savings for you.

STOKES Multiple Punch Rotary Press for large production – Model "B"

A few examples of the wide variety of products successfully compressed on Stokes Tableting Machines – only one item in a complete line of Chemical Process Equipment:

- Molding Compounds
- Catalyzer Tablets
- Carbon Products
- Dyestuffs
- Drugs
- Water Color Paints
- Chemical Specialties
- Electrical Resistance Discs and Insulators, etc., etc.

STOKES Chemical Process Equipment

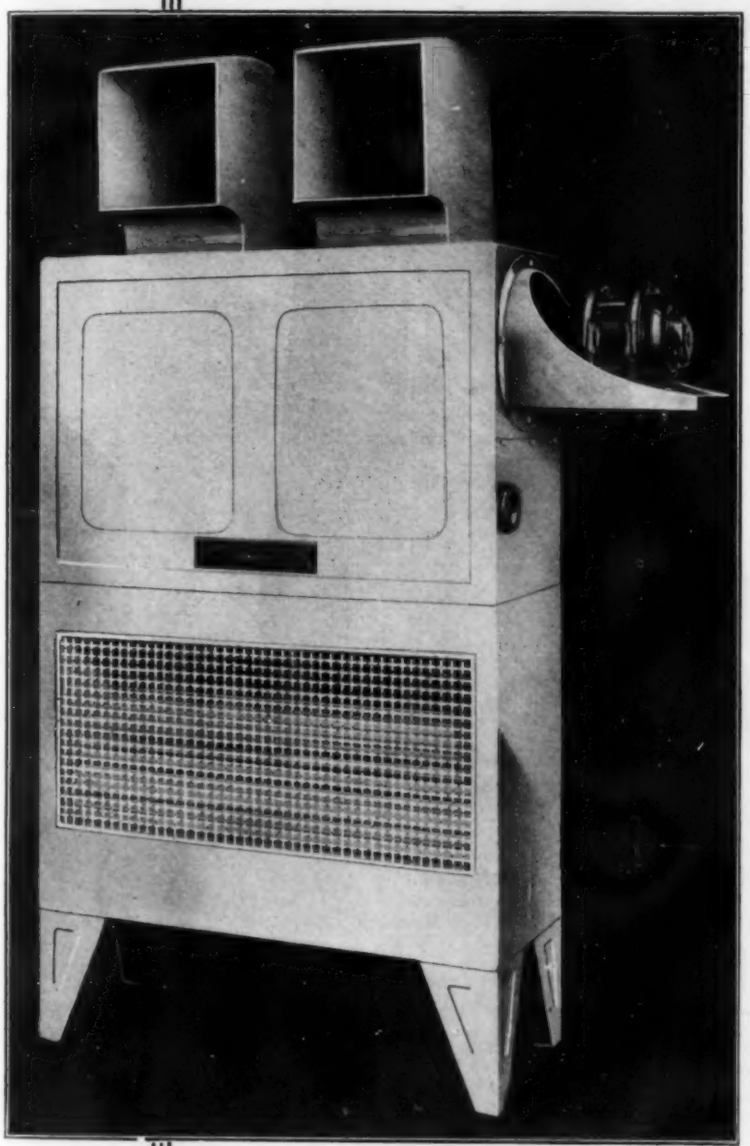
Atmospheric Drum Dryers	Vacuum Pumps
Vacuum Rotary Dryers	Nitrators
Vacuum Shelf Dryers	Sulfonators
Vacuum Drum Dryers	Tableting Machines
Impregnating Apparatus	Cooling and Flaking Drums
Evaporators	Mixers
Solvent Recovery Apparatus	Special Equipment
Condensers	Etc., etc., etc.

FJS STOKES MACHINE COMPANY

Chemical Engineers and Equipment Manufacturers since 1898

5920 Tabor Road Olney P. O. Philadelphia, Pa.

This is the new "Buffalo"



Wetboy

A Unit Heater That Washes, Heats and Humidifies Air

Since the advent of the unit heater there has been a real need for a unit that would wash and humidify — at a moderate price!

The Buffalo Wetboy offers you an ideal heater with the cleaning efficiency of a scrubber washer.

The Wetboy is simple—no pump—no outside mechanism, self contained, and easily cleaned.

Get the whole story!

PATENTS APPLIED FOR

UNIVERSAL AEROFIN

Of course, the heating coil used is non-corrosive lightweight, Universal Aerofin.

Buffalo Forge Company

501 Broadway, Buffalo, N. Y.

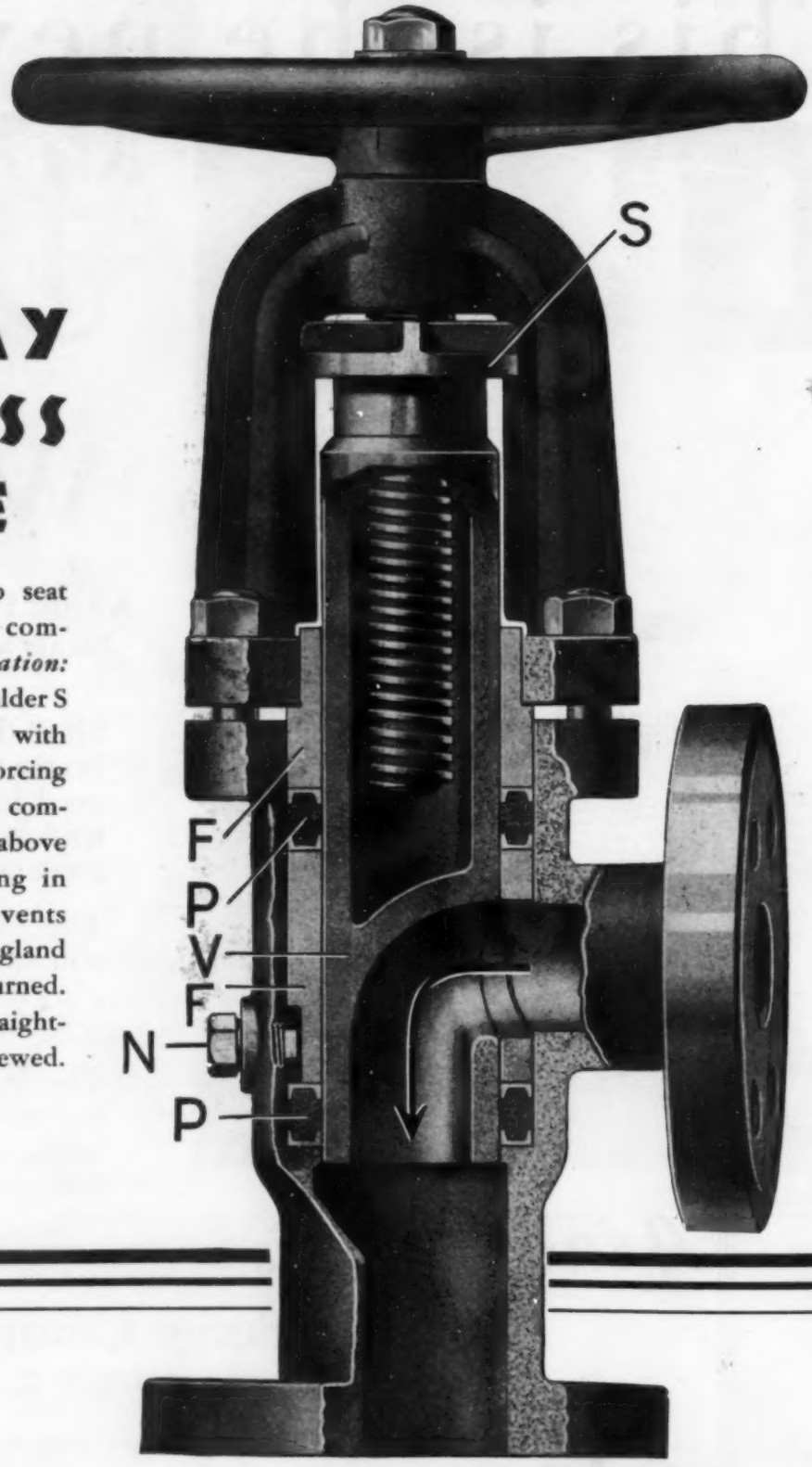
In Canada:
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" Highboy, Lowboy and Wetboy Unit Heaters

...HERE IS THE

YARWAY SEATLESS VALVE

Long lasting—tight—no seat to leak—automatically compressed packing. *Operation:* After valve is closed, shoulder S on plunger V contacts with upper follower gland F, forcing this down into body and compressing packing P, both above and below port opening in body. Set screw N prevents turning of lower follower gland F when hand wheel is turned. Built in both angle and straightway types, flanged and screwed.



YARWAY

VALVE THAT LASTS IN DIFFICULT SERVICE

THE Yarway Seatless Valve is the answer to the difficult problem of controlling liquid and vapor flow in the process industries. The construction overcomes sticking, and the absence of a seat precludes the possibility of leakage at that vital point.

Note these outstanding features in the sectional view on the opposite page:

V—The Tubular Plunger, made of seamless, heat- and corrosion-resisting tubing. It presents a smooth, unobstructed surface to the flow of the liquid or vapor.

P—Packing Rings. These rings become compressed when the valve is closed and form an effectual seal against leakage above and below port opening.

These two parts comprise the seatless feature of Yarway Valves, eliminating the necessity for a seat with its attendant difficulties and making the valve hold tight even under the severest conditions.

Yarway Seatless Valves are in successful use on cross-still service, fibre presses, paper digesters, rubber devulcanizers, soap vats, boiling tanks, autoclaves, tar-distillation lines—in short, nearly everywhere throughout the industry where the hardest service is required.

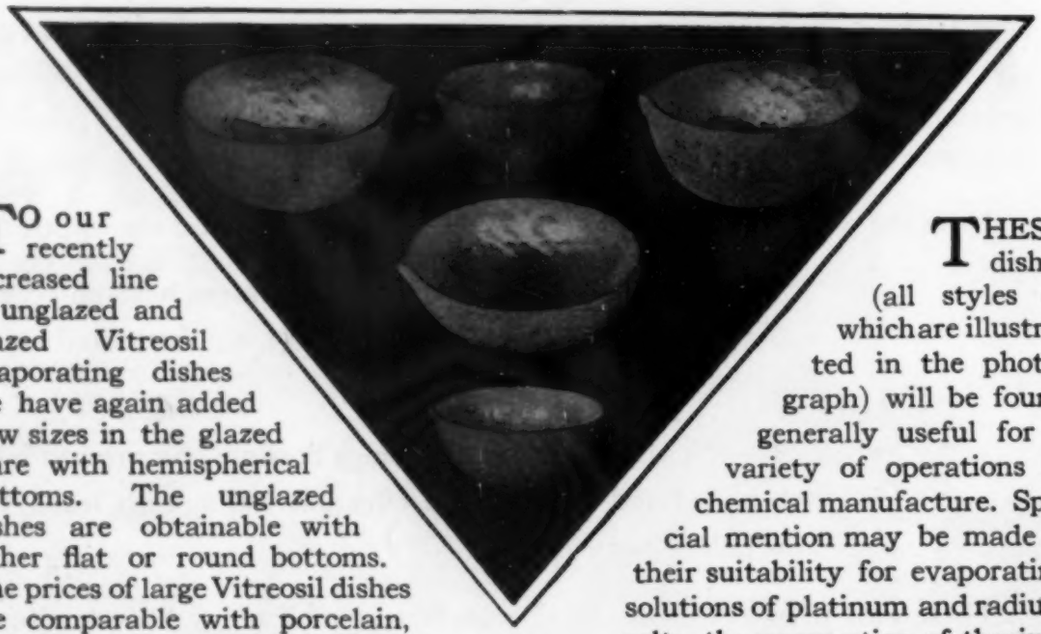
Tell us the most difficult valve job you have to contend with in your plant. We will furnish complete information regarding what Yarways have done in similar service elsewhere.

YARNALL-WARING COMPANY
7700 Devon Street Philadelphia

VALVES

NEW VITREOSIL DISHES

. . . Glazed or Unglazed . . .



TO our recently increased line of unglazed and glazed Vitreosil evaporating dishes we have again added new sizes in the glazed ware with hemispherical bottoms. The unglazed dishes are obtainable with either flat or round bottoms. The prices of large Vitreosil dishes are comparable with porcelain, with the advantage of being least affected by acidic conditions and security against breakage through sudden temperature changes.

THESE dishes (all styles of which are illustrated in the photograph) will be found generally useful for a variety of operations in chemical manufacture. Special mention may be made of their suitability for evaporating solutions of platinum and radium salts, the preparation of thorium nitrate, mercuric oxide, ammonium tungstate, and tungstic oxide and the resublimation of iodine.

Cat. No. Small Lip*	B.3 •	B.5 •	B.9 •	B.10 •	B.11 •	B.12 •	B.13 •	B.15 •	B.17 •	B.19 •	B.21 •	B.23 •	B.25 •	B.27 •	B.29 Lrg Lip	B.29 •	B.31 •	B.32 Lrg Lip	B.32 •	B.33 •	B.35 Lrg Lip	B.35 •
Approximate Capacity Liters	.045	.080	.100	.200	.400	.500	.600	.700	.800	1.2	1.4	1.8	1.8	2.5	3	4.25	3	10	13.25	15	20.25	22.5
Glazed Round Bottom	$1.50	1.65	2.15	2.50		6.35	8.00	8.35	10.25	10.45	21.25	22.25	25.85	26.75								
Unglazed Round Bottom					$3.85		4.15	4.65	5.00	5.15	5.85	6.65	7.50	8.35	9.40	9.40	11.25	13.25	13.25	13.25	14.25	14.25
Unglazed Flat Bottom											$5.85		7.50		9.40	9.40	11.25			13.25	14.25	14.25

Write for Literature

The THERMAL SYNDICATE *Ltd.*

64 Schenectady Avenue Brooklyn, New York

One year without repair —and still running

THIS G-E totally enclosed, fan-cooled motor has just completed its first year of service in a sandpaper plant. It has operated, without repair, under the extremely severe conditions that caused previous motors to fail in from six to eight weeks.

G-E totally enclosed, fan-cooled motors are available for direct current or alternating current, single-phase or three-phase, and are interchangeable, in the popular sizes, with ball-bearing open motors.

Ask the nearest G-E office how you can use these motors to reduce maintenance and obviate insulation troubles.

G-E totally enclosed, fan-cooled motor driving sandpaper-making machine

GENERAL ELECTRIC

GENERAL ELECT

THIS IS A GOOD PAGE AT WHICH TO STOP!

because—

it contains some remarks by leading manufacturers that will guide you in your selection of chemical equipment

HANOVIA CHEM. & MFG. CO.
Newark, New Jersey . . . . .

"We have been using Pfaudler equipment for many years, and while we do not feel like furnishing specific data as to the products which we are treating in this equipment we can truthfully state that it has given us excellent service and is likely to last for quite a number of years to come."

* * *

HYNSON, WESTCOTT & DUNNING
Baltimore, Maryland . . . . .

"We are using Pfaudler chemical equipment extensively in the manufacture of Mercurochrome and also in the production of Phenolsulphonphthalein which is so extensively used by the medical profession in making kidney functional tests and also other sulphonphthaleins which are largely used in the colorimetric determination of hydrogen ion concentration."

* * *

THE HALOID COMPANY
Rochester, New York . . . . .

"We are pleased to state that we have in constant use 11 of your acid-resisting glass-lined steel kettles for handling photographic emulsions at various degrees of acidity or alkalinity. These kettles are subjected to rapid changes of temperature and several have been in service for from five to ten years without repairs."

* * *

BECKWITH-CHANDLER CO.
Newark, New Jersey . . . . .

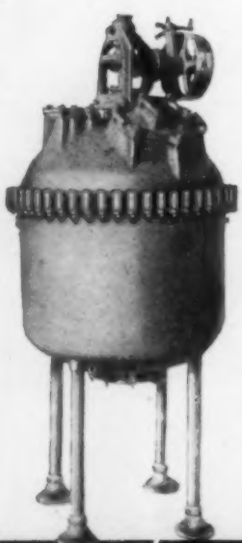
"We have two 500-gallon Pfaudler glass-lined mixing tanks which we use for the storage of our white lacquers and find that they work out very well for this purpose."

THE PFAUDLER CO.
***Chemical Division,* Rochester, N. Y.**

Pfaudler

Specify Pfaudler Glass Lined Steel Equipment. It will protect your product against metallic contamination, resist corrosion for long periods of time, and will reduce your overhead.

Reaction Kettle, shown below, is made for processing such corrosives as sulphuric, nitric, hydrochloric, muriatic, arsenic acids, etc. Get our Catalog No. 689!



EASTMAN KODAK CO.
Rochester, New York . . . . .

"We use Pfaudler equipment in various departments at Kodak Park and for many different purposes. It would, therefore, be difficult for us to list the individual installations of Pfaudler equipment which are now in service. We have found Pfaudler equipment very satisfactory."

* * *

NELSON, BAKER & CO.
Detroit, Michigan . . . . . .

"We have been using Pfaudler chemical equipment for the past 15 years for processing different pharmaceutical preparations, such as Milk of Magnesia, Elixirs, Syrups, etc. We must say that your equipment is the best we have found."

* * *

BUESCHER BAND INSTRUMENT CO.
Elkhart, Indiana . . . . . .

"We have six of your glass-lined tanks in use in our plating department. These tanks are used for gold plating solutions and are heated by an open gas flame. They have been in continuous service for about eight years and have proved very satisfactory."

* * *

THE CELLULOID CORP.
Newark, New Jersey . . . . .

"We are using your glass-lined tanks for mixing and storing dopes made of nitro cellulose and cellulose acetate and they are very satisfactory."

BRANCH OFFICES

NEW YORK
8 West 40th St.

CHICAGO
1442 Conway Bldg.

ELYRIA, O.
Pfaudler-Elyria Div.

SAN FRANCISCO
122 New Montgomery St.

PFAUDLER EQUIPMENT

glass-lined

And now

The American Tobacco Co., Inc. uses Pulverized Coal Firing

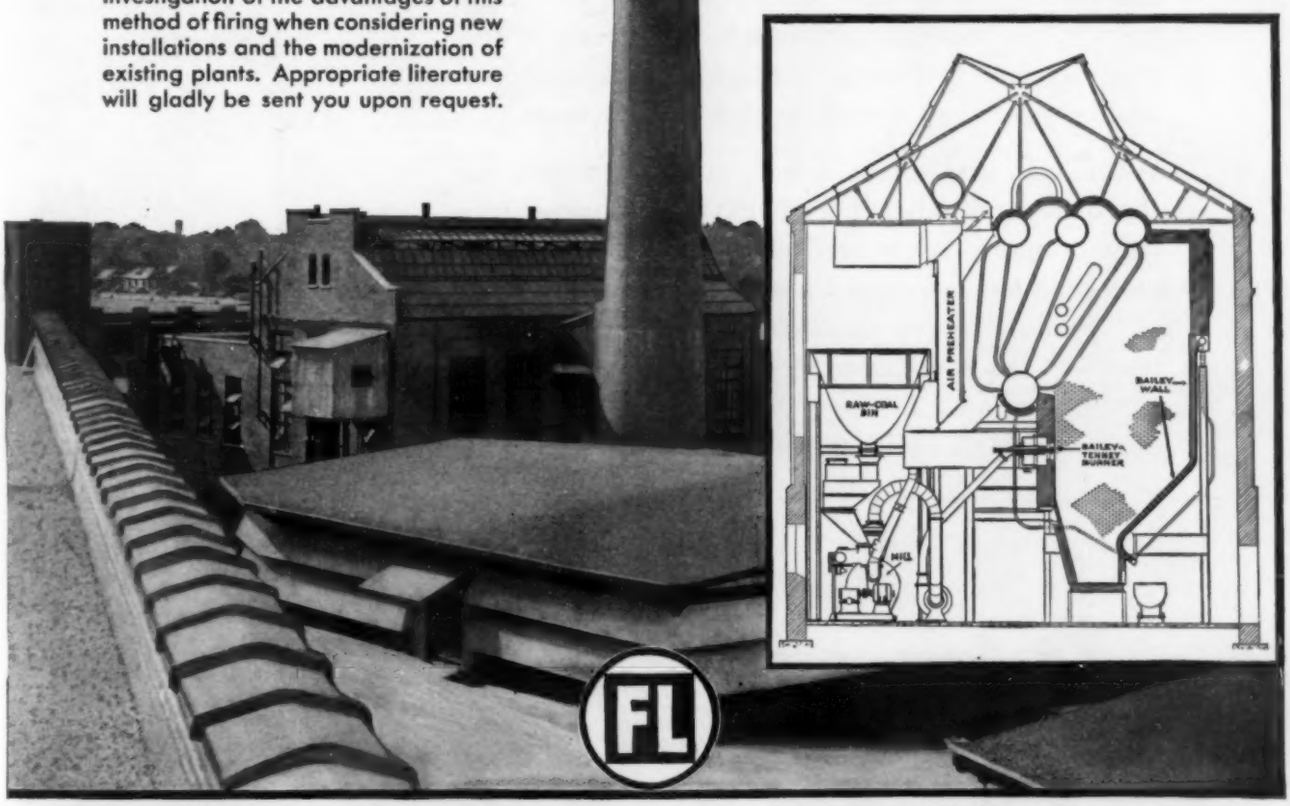
ECONOMY of building space is one of the outstanding features of the Fuller Lehigh Direct-Fired Pulverized-Coal Installation at the Reidsville, N. C., plant of The American Tobacco Company, Incorporated, J. E. Sirrine & Company, Consulting Engineers, Greenville, S. C.

The compact arrangement of equipment was made possible by firing from beneath the boiler mud drum and by locating the raw-coal bunkers and weigh scales immediately above the hoppers of the pulverizers.

One Bailey-Tenney Burner and one Fuller-Bonnot Mill are used on each of the three boilers, the boilers being fired through the down-take wall. The up-take wall and the up-take hopper floor of each furnace are of Bailey Water-Cooled Furnace Construction.

FULLER LEHIGH COMPANY
A Babcock & Wilcox Organization
FULLERTON, PENNA.

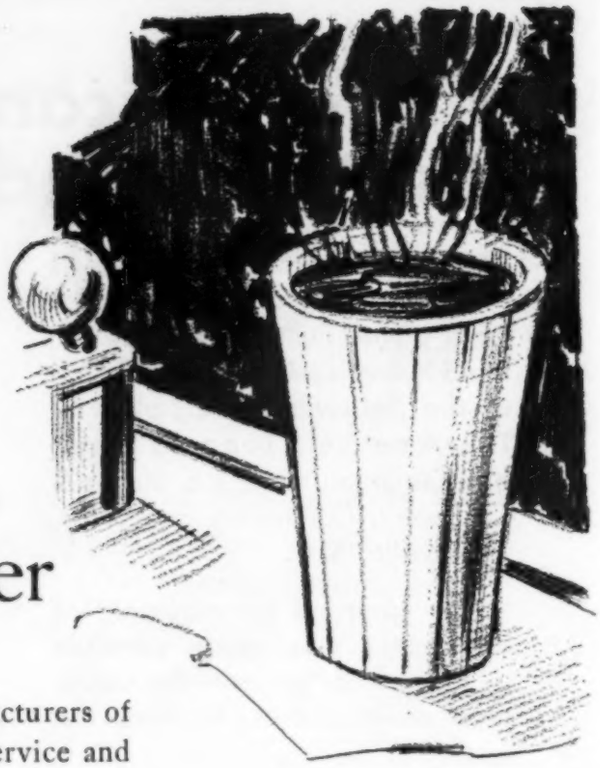
The rapid growth in the use of pulverized-coal firing warrants a thorough investigation of the advantages of this method of firing when considering new installations and the modernization of existing plants. Appropriate literature will gladly be sent you upon request.



FULLER LEHIGH

PULVERIZED-COAL EQUIPMENT ~ WATER-COOLED FURNACE WALLS

1—69



WANTED!

. . . a paper container

Eight years ago one of the largest manufacturers of paper containers, alert to expanding its service and volume of sales, saw a wider market if the use of paper containers could be extended to the packaging and dispensing of new food products. For eight years it has been our privilege to co-operate in this program and to handle research and development problems of every nature for this manufacturer.

When you step up to a soda fountain where hot chocolate and other hot drinks are dispensed in sanitary paper containers, or when you take home such products as frozen fruits, oysters, cottage cheese and peanut butter, you have in concrete form the results of the application of chemistry and engineering to every step in the manufacture of paper containers, beginning with the buying of the paper itself.

Your problems may not be the same as those of the paper container manufacturer, but the experience we have acquired in solving his problems—and others too—will also help to solve yours.

An outside viewpoint is a valuable means of getting at the inside of a problem.

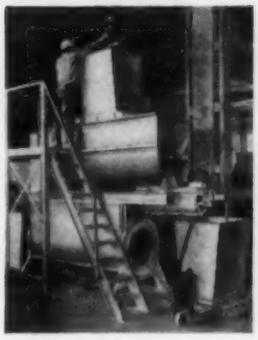
WEISBERG & GREENWALD

ENGINEERS—CHEMISTS

71 West 45th Street, New York City

WOLF MIXERS

are built for the needs of the process industries



The Porcelain Enamel and Manufacturing Co., of Baltimore, Md., is one of many firms using a battery of Wolf Horizontal Mixers to handle their processing needs.

Wolf has had years of experience in building rapid, substantially constructed mixers for handling all kinds of crushed or pulverized materials.

We are frequently called on to furnish special arrangements of mixing, grinding and sifting equipment and gladly give our customers the facilities of our engineering and testing departments.

This key may unlock your problem

Send us a sample of your product. We will gladly process it in our modern laboratory to show you what Wolf equipment can accomplish for you in accuracy, economy and results.

THE WOLF COMPANY
100 COMMERCE ST.
CHAMBERSBURG, PA.

Special Alloy

Epochs In Iron No. 3

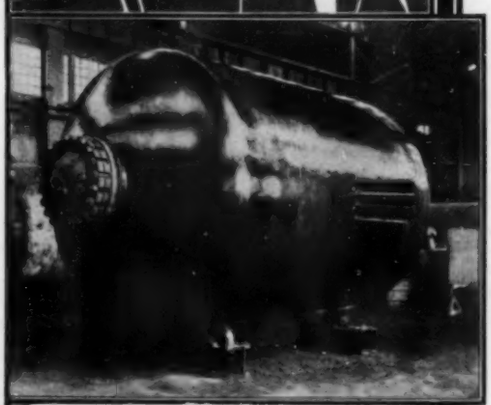
The Primitive Smelter

FROM the heap of ore and burning wood, primitive man finally progressed to a crude smelter.

Hardly more than a hole in a clay bank—with crude skin bellows for blast—yet it was the fore-runner of our great modern smelter. With it he could make iron faster—and of better quality. This crude smelter heralded in the iron age.

Blaw Knox Welding—Forge and Hammer—Electric—Gas—Special Alloy—has heralded a new era of weld fabricated products.

Our perfected, scientific method of Forge and Hammer Welding produces bottle tight pressure vessels—homogeneous, and of enormous strength—capable of withstanding tremendous pressure and wide, sudden variations in both temperatures and pressures.



Forge and Hammer Welded High Pressure Digester

BLAW-KNOX CO.

WELDING HEADQUARTERS

PITTSBURGH, PENNA.

FANSTEEL

If you make a compound of phosphoric acid

—for instance TANTALUM

. . . may be just the answer to your corrosion problems

DESPITE the fact that we drink phosphate beverages, use phosphate baking powders, self-rising flours, etc., *phosphoric acid* in concentrated form continues to be extremely corrosive. Few metals permanently withstand its influence. TANTALUM is one of these.

In fact, corrosion tests of 10% and 85% solution of phosphoric acid and TANTALUM have demonstrated a rating of "excellent"—namely, resistance to corrosion of such a degree in laboratory and service that *years of life* are obtained.

We quote this instance simply to drive home the fact that there are many processes and products in the chemical field in which the use of TANTALUM may not have been yet fully considered and its great advantages not realized.

The single outstanding fact that TANTALUM is not affected by sodium hydroxide or *any acid* save hydrochloric, indicates its immense possibilities in combating corrosion all through industrial chemistry.

Turn this page and study the characteristics of TANTALUM. Then ask our engineers to give you their opinion as to the advantage of using TANTALUM at some exceptionally difficult spot in your process.

TANTALUM
an element
NOT
an alloy

FANSTEEL PRODUCTS COMPANY, Inc.

NORTH CHICAGO, ILLINOIS

Eastern District Office, 52 Vanderbilt Ave., New York

TANTALUM

Characteristics of TANTALUM Compared with Other Metals

Characteristics	Tantalum	Tungsten	Molybdenum	Platinum	Copper	Nickel
Atomic number	73	74	42	78	29	28
Atomic weight	181.5	184	96	195.2	63.57	58.7
Density, at 20° C.	16.6	19.3	10.2	21.46	8.89	8.9
Atomic volume	10.9	9.4	8.8	9.25	7.15	6.6-6.8
Tensile strength lbs. per sq. in.	130,000	490,000	260,000	53,000 35,000	62,000 35,000	155,000 hard 76,000 annealed
Compressibility per unit volume per Kg/Cm²	.52x10⁻⁶	.26x10⁻⁶	.46x10⁻⁶	.37x10⁻⁶	.74x10⁻⁶	.42x10⁻⁶
Brinnel hardness at 500 Kg.	45.9	290	147	90 hard 35 annealed	94 hard 40 annealed	83
Scleroscope hardness	10	40	12	24 hard 13 annealed	18 hard 6 annealed	45 hard 10 annealed
Young's modulus of elasticity, kg. per sq. mm.	19,000	42,200			12,200	22,000
Melting point ° C.	2850	3370	2620	1755	1083	1452
Boiling point ° C.	4100	5900	3700	4300	2300	2900
Vapor pressure		6.45x10⁻¹² mm 1727° C. .00114 mm. at 2727° C.	6430x10⁻¹² mm at 1517° C.	107x10⁻⁶ at 1727° C.	.001 mm at 1080°	
Heat of vaporization, total, cal. per gm.		129,000	113,000	88,000	76,600	84,000
Special heat cal. per gm. per °C, at 0° C.	.0365	.0336	.0647	.0323	.0910	.1084
Linear coefficient of expansion per °C.	6.5x10⁻⁶	4.44x10⁻⁶	5.45x10⁻⁶	9.0x10⁻⁶	17x10⁻⁶	12.8x10⁻⁶
Thermal cond. in cal. per cm. per cm². per sec. per ° at 18° C.	.130	.476	.346	.1664	.918	.142
Heat of combustion cal. per gm.	827	1040	1812	87.1	547	983
Heat of combustion cal. per gm. atom.	300,120	191,400	173,950	17,000	34,890	57,826
Temp. coefficient of resistance at 20 °C.	.0031	.0045	.0033	.0031	.00393	.0066
Electrical resistance microhm per cm. cube at 20° annealed.	15.5	5.51	5.7	10.0	1.72	6.4
Magnetic susceptibility	+.93x10⁻⁶	+.33x10⁻⁶	+.04x10⁻⁶	+1.1x10⁻⁶	-.085x10⁻⁶	variable
Electrochem. equiv. mg. per coulomb.	.3762	.31788	.1658	.5057	.3294	.3040
Refractive index	2.05	2.76		1.17	1.39	1.41
Thermoelectric E.M.F. against copper micro-volts per degree	4.1	4.5 (Above 200° C.)		13.3	0.0	25

Chemical properties

The most characteristic chemical property of Tantalum is its unusual resistance to chemical corrosion. It is not attacked by hydrochloric or nitric acids or by *aqua regia*, either hot or cold. It is not attacked by dilute sulfuric acid at ordinary or more elevated temperatures, but appears to be slowly attacked by boiling, concentrated sulphuric acid. Solutions of caustic alkalies do not attack the metal easily. Hydrofluoric acid seems to be the only chemical agent which will attack it, and in the case of very pure metal and very pure hydrofluoric acid the action is very slow. A mixture of hydrofluoric and nitric acids will attack the metal with avidity, causing it to go into solution as Tantalum fluoride.

If Tantalum is heated in the air, the surface becomes blue at a temperature of about 400° C., and at a somewhat higher temperature, nearly black. Above a dull red heat the white oxide is produced and the metal gradually burns. This metal combines with avidity with hydrogen, oxygen, or nitrogen. It will take up 740 times its own volume of hydrogen, producing a very coarse-grained, brittle product.

Tantalum containing dissolved gases will be harder than the pure metal, and if their quantity is appreciable the metal may even be brittle—*so all annealing or heating operations with Tantalum must be carried out in a vacuum.* Solutions of chlorine or the gas itself are without any action on the metal. Tantalum is not affected by any of the chemicals or antiseptics used in dentistry or surgery.

Corrosion Data

In this table, the words opposite the corrosive agent have the following meanings:

EXCELLENT: Resistance to corrosion of such a degree in laboratory and service tests that a long life of years is obtained.

GOOD: Commercially long life is obtained.

FAIR: The material may be used when cost is not a consideration.

POOR: The material is useless.

Form of material—Commercial sheets, wires and bars.

Sulphuric Acid	Dilute	Excellent
	Concentrated and below boiling point	Excellent
Nitric Acid	Very dilute	Excellent
	Concentrated	Excellent
Hydrochloric Acid	Dilute	Excellent
	Concentrated	Excellent
Aqua Regia		Excellent
Hydrofluoric Acid		Poor
Hydrofluoric and Concentrated Nitric Mixed		Poor
Acetic Acid	10% Solution	Excellent
	Concentrated (glacial)	Excellent
Formic Acid	12% Solution	Excellent
	50% Solution	Excellent
Oxalic Acid	10% Solution	Excellent
Phosphoric Acid	10% Solution	Excellent
	85% Solution	Excellent
Carbolic Acid	5% Solution	Excellent
Citric Acid Solution		Excellent
Tannic Acid	15% Solution	Excellent
Sodium Acetate	20% Solution	Excellent
Iodine Solution	10% Solution	Excellent
Chlorine Solution		Excellent
Sodium Hydroxide	Dilute Solution	Good
	Hot Concentrated	Poor
Potassium Hydroxide	10% Solution	Excellent
Ammonium Hydroxide		Excellent
Sea Water		Excellent
Sea Air		Excellent
Moist Atmosphere		Excellent
Moist Sulphurous Atmosphere		Excellent
Mine Waters		Excellent
Gases Containing Carbon Monoxide		Excellent

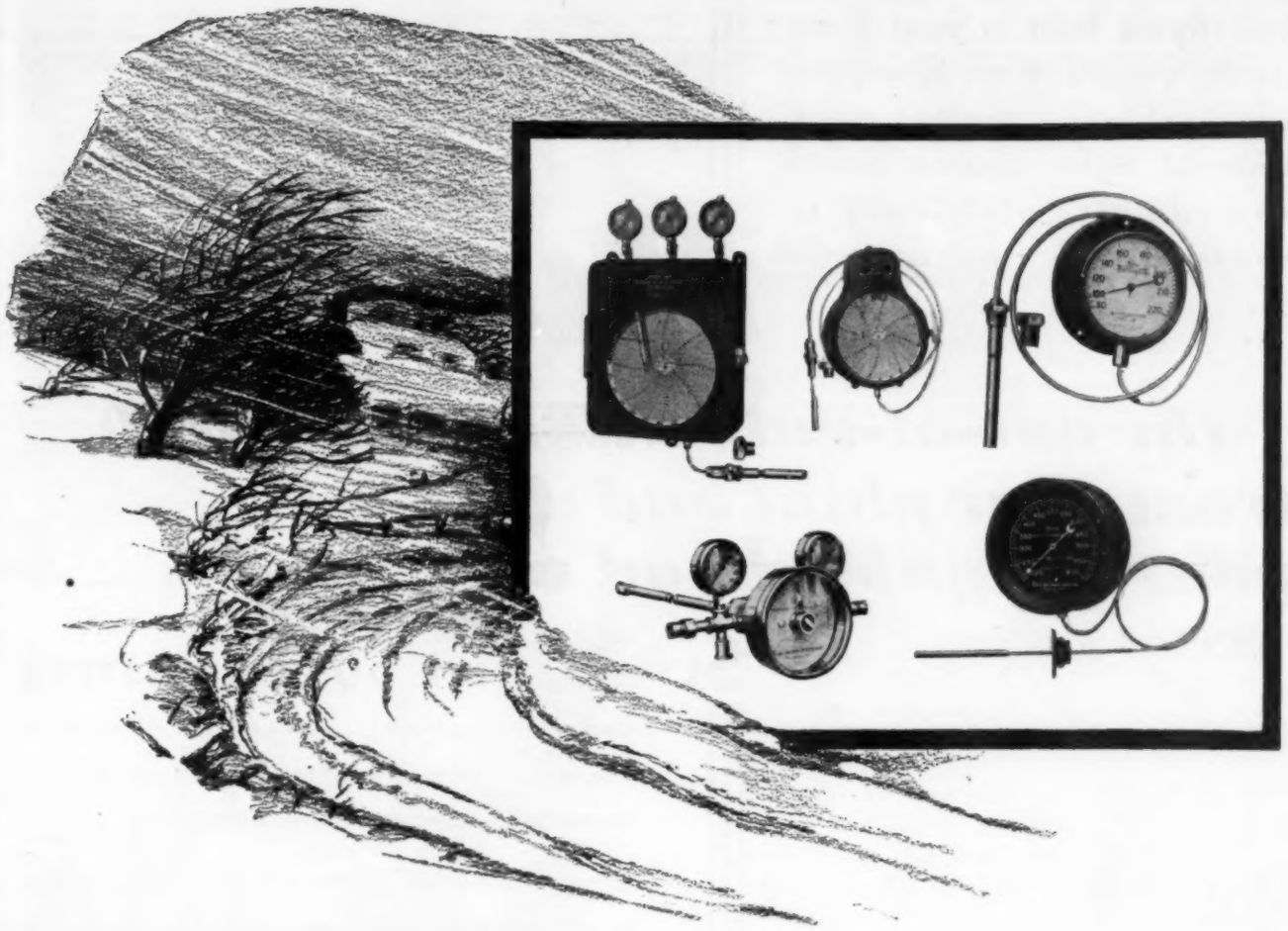
This table takes the form of the table on corrosion worked out by the committee of the Society for Testing Materials under the chairmanship of Jerome Strauss. The ratings given are conservative and it is recommended that the Tantalum be sampled by the user for special processes.

FURTHER INFORMATION IS AVAILABLE ON REQUEST

FANSTEEL PRODUCTS COMPANY, Inc.

NORTH CHICAGO, ILLINOIS

Eastern District Office, 52 Vanderbilt Ave., New York



Low temperatures are held to the mark with *Tycos*

The first *Tycos* Instrument was made seventy-five years ago. The Process Industries—the infants in the world's advancement even though they tower giant-like in wealth and importance—have progressed with the improvements in temperature indicating, recording and controlling instruments.

***Tycos* Instruments are the most widely used in the eleven major divisions of the Process Field where Refrigeration is an important factor.**

Consult with Tycos Engineers. Their experience holds the mastery of your problem.

Taylor Instrument Companies
ROCHESTER, N. Y., U. S. A.
Canadian Plant: *Tycos* Building, Toronto
Manufacturing Distributors in Great Britain:
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Tycos INDICATING—RECORDING—CONTROLLING
Temperature Instruments

Free-flying Dust in your plant slows up workmen, wears out machinery, wastes good material, fights against safety and impairs efficiency in every dusty operation—

Banish

the out-of-date dust-nuisance from your plant and your neighborhood!

SLY POSITIVE DUST ARRESTERS

are removing dust .... in hundreds of modern plants .... in many different industries .... thoroughly, economically—positively.

Simple, time-tried filtration in Sly Dust Arresters is actually removing dusts as fine as 500-mesh —an impalpable powder—from enormous quantities of air every day .... so thoroughly that the air can be returned to the plant for re-use to save on heating costs .... so economically that the value of the salvaged dust-material alone in many cases pays for the whole operation, without figuring the profits from increased efficiency, greater safety, and decreased maintenance costs on dust-free equipment.

Experience gained in many hundreds of successful installations, in forty-five different kinds of industrial dust, is at your service. Our Bulletin S-125 contains detailed information. May we send it to you?

THE W. W. SLY MANUFACTURING COMPANY
4733 TRAIN AVENUE :: CLEVELAND, OHIO

SLY POSITIVE DUST ARRESTERS

DIXONS INDUSTRIAL PAINTS

Last from Eight to Fifteen Years

When you place an order for "paint" you are really buying *protection*—against corrosion or deterioration of the surfaces to which it is to be applied. And records from many big users show that Dixon's Industrial Paints give *longer and better protection* than can be secured in any other way for the same ultimate expense.

The reason is simple. When used over Dixon's Red Lead Graphite Primer, and applied under favorable circumstances, Dixon's Industrial Paints will give from eight to fifteen years' service. That means a saving of at least one repainting in comparison with ordinary paint used under similar circumstances.

Dixon's Industrial Paints,

with the exception of *Bright* Aluminum and Standard Red Oxide, are composed of pure boiled linseed oil, combined with coloring matter, and the highest grade of flake silica-graphite. Fourteen standard colors. Write for color card No. 243BI.

Dixon's Maintenance Floor Paints

give maximum protection to wood, composition, concrete and cement floors. Suitable for use either indoors or outside. Eight standard colors. Write for color card No. 243BF.

Every time you buy cheap paint you add to your painting costs

This is true because two thirds of the cost of an industrial paint job is labor cost. And when you "save" a few cents a gallon on paint you have the big labor cost of repainting long before it is properly due.

Paint Sales Division

JOSEPH DIXON CRUCIBLE CO.

Jersey City, New Jersey

Established 1827

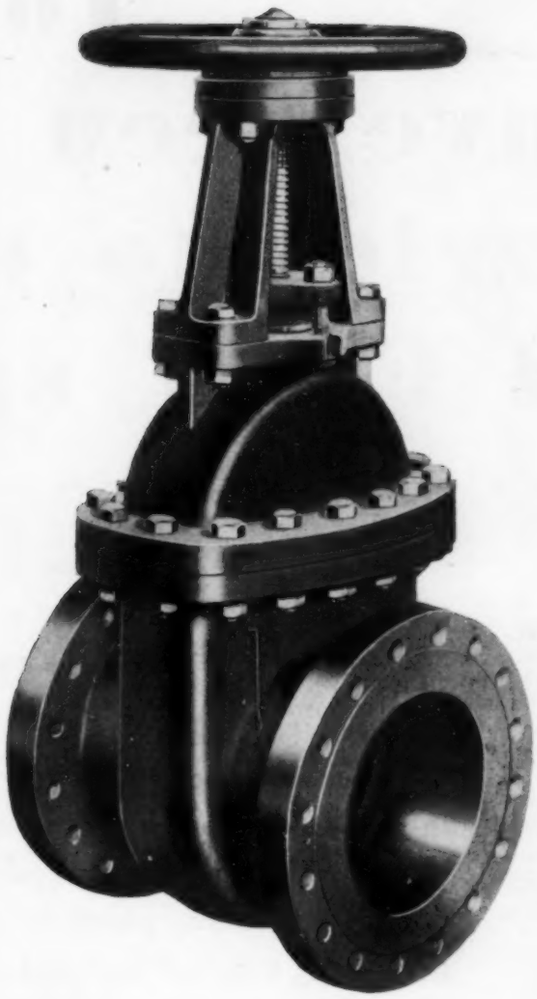
how may NITRALLOY be compared to ordinary "rust-proof" metal ?*

THE discovery of the rustless properties of the nitrided case (the extra-hard surface that the nitriding process puts on steel) has a two-fold significance. The primary result is, of course, a rustless material that is also extremely hard. NITRALLOY was developed with a super hardness and wear resistance as the main objectives, while "rustless" metal aimed first at the production of a material with a stable surface property, in which the hardness of the surface was of *secondary* importance.

On the other hand, these two classes of materials differ in that the rustlessness of ordinary rustless steel is obtained by the use of large percentages of alloys, such as chromium, nickel, etc., while the rustlessness of NITRALLOY is conferred by the hardening process itself, acting of course upon the special steels which in the unnitrided condition are not rustless.

In the last analysis, the one property desired above all others is resistance to wear in the use for which the part is designed and the performance of this function uninterrupted by shut-downs for repairs and replacements.

*THIS is the sixth of a series of discussions in these pages, on the properties and applications of CHAPMAN . . . produced NITRALLOY for Valve Mountings.



Briefly . . . "Nitralloy," recommended by Chapman for super-hardness and super-wear-resistance, is the ideal metal for those parts of valves exposed to wear and erosion. Tests of sliding action (as of valve discs against valve rings) showed only .0005 actual wear, after 100,000 strokes, metal to metal, at varying pressure from 100 to 300 pounds.

CHAPMAN "Nitralloy" wearing parts (seat rings and plug faces) in your valves, then, means performance uninterrupted by shut-downs for repairs or replacements.

CHAPMAN VALVE MFG. CO.

Indian Orchard, Mass.

To those who have been asking for nozzles to deliver a *good* FLAT spray—

Spraco has them—a complete line of nozzles for flat spray work, adaptable for many uses where a conical spray is unsatisfactory.

Used for washing scale off large steel ingots as they come from the rolling mill; for washing fruit; for many other purposes; these Spraco nozzles help many plants to obtain economies previously believed impossible.

A Spraco nozzle for producing a flat spray

A wide range of sizes made in nearly every kind of material provides a complete line which covers all applications.

Bulletin 463 illustrates and describes Spraco nozzles for every industry, gives tables of sizes and capacities and much other valuable information. Write for a copy.

SPRACO
INCORPORATED
115 CENTRAL STREET SOMERVILLE, MASS.
3548

Compressor Users . . .

IN the development of Horizontal Duplex Type Compressors, Worthington has made a real contribution to industrial progress. These compressors, as now produced in a comprehensive range of sizes for either direct-connected-motor or belt drive, are the result of 25 years of specialized effort.

The story of this equipment with its numerous exclusive features has been prepared in the form of a 32-page illustrated bulletin. We believe that every compressor user will want a copy.

Just fill in and mail the coupon below.

WORTHINGTON PUMP AND MACHINERY CORPORATION

Works: Harrison, N. J. Cincinnati, Ohio Buffalo, N. Y. Holyoke, Mass.
Executive Offices: 2 Park Avenue, New York, N. Y.
GENERAL OFFICES: HARRISON, N. J.

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Atlanta	Chicago	Dallas	El Paso	Los Angeles	Philadelphia	St. Paul	Seattle
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PUMPS
COMPRESSORS
CONDENSERS *and* Auxiliaries
DIESEL ENGINES
GAS ENGINES
FEEDWATER HEATERS
WATER, OIL *and* GASOLINE METERS

Literature on Request

WORTHINGTON

B-27

WORTHINGTON PUMP AND MACHINERY CORPORATION
Harrison, N. J.

Date .....

Gentlemen: — I shall be glad to have a copy of your Bulletin L-612-B1, covering Worthington Horizontal Duplex Type Compressors.

Name .....

Position .....

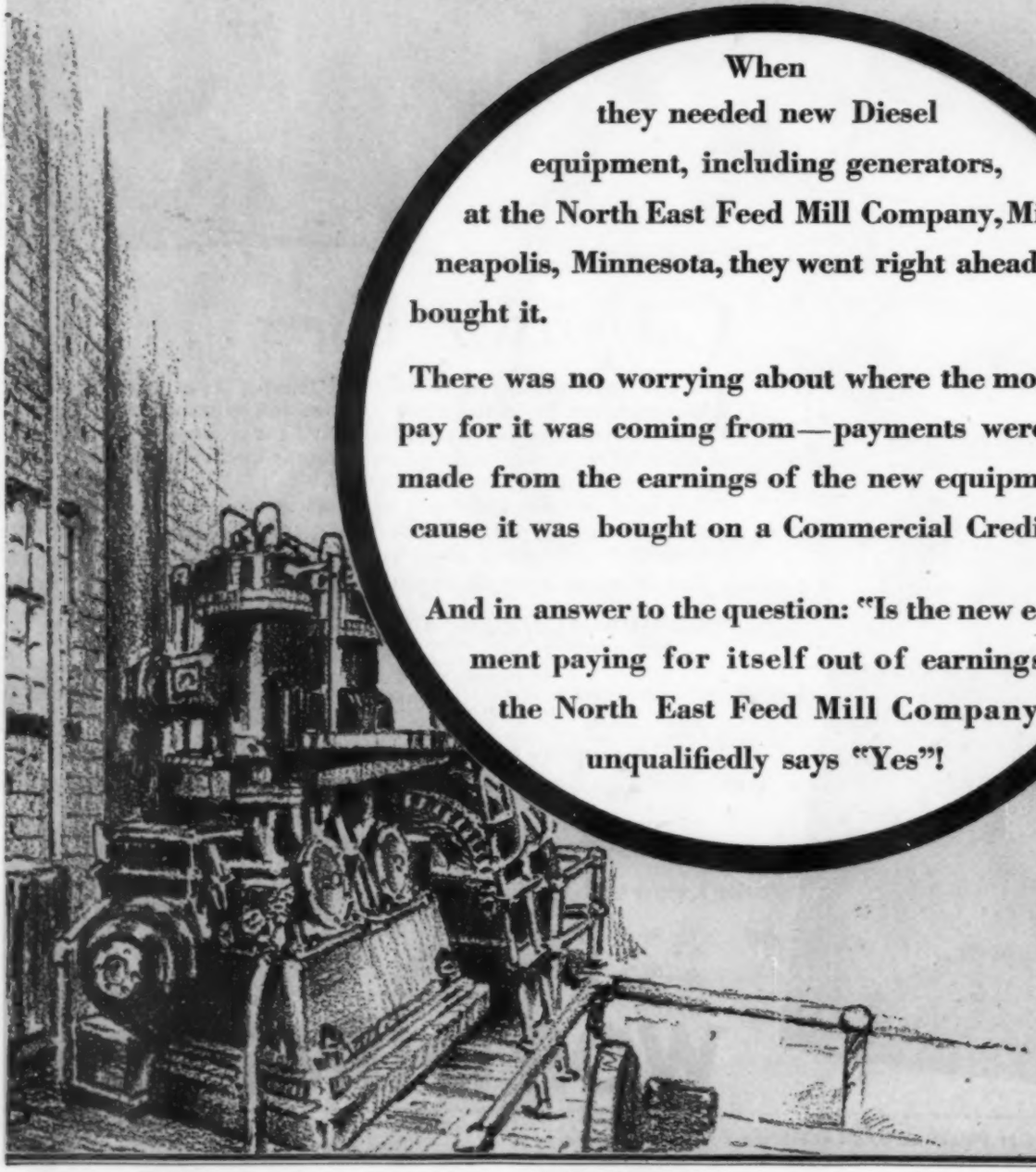
Organization .....

Address .....

.....

.....

It is CONVENIENT to



When they needed new Diesel equipment, including generators, at the North East Feed Mill Company, Minneapolis, Minnesota, they went right ahead and bought it.

There was no worrying about where the money to pay for it was coming from—payments were to be made from the earnings of the new equipment because it was bought on a Commercial Credit Plan.

And in answer to the question: "Is the new equipment paying for itself out of earnings," the North East Feed Mill Company unqualifiedly says "Yes"!

Wherever you are . . . Whatever you make, sell or buy

COMMERCIAL CREDIT

CASH CAPITAL & SURPLUS

PAY from EARNINGS

COMMERCIAL CREDIT COMPANIES

COMMERCIAL BANKERS

National Headquarters, Baltimore

Gentlemen:

Tell us, without obligation, how we can BUY / SELL *on Commercial Credit plans.*

Firm Name.....

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By.....

. . . Investigate Commercial Credit Service

COMPANIES

$57,000,000.00

COMMERCIAL BANKERS

Lower Production Costs through Linde

"One-fifth

off our entire production cost of steel barrels is the result to us of Linde Process Service," says a prominent manufacturer, "an annual saving running well into five figures."

This manufacturer was effectively using the oxy-acetylene process of welding and cutting when Linde was called in. He was already taking advantage of all its apparent economies in both production and maintenance. Still, through the broader and more comprehensive experience of the Linde Service organization, this important additional saving was effected.

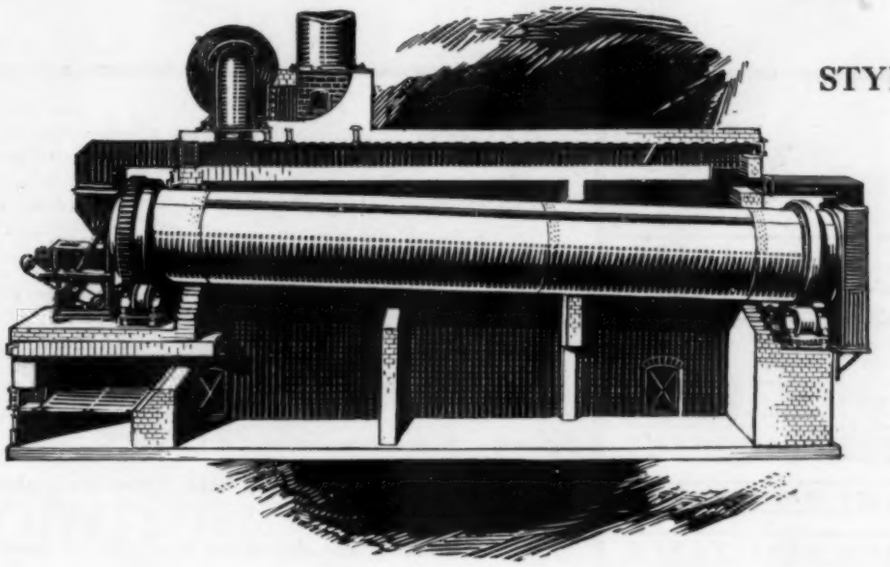
Linde Process Service is but one reason why Linde Oxygen has the greatest sale of any oxygen. This Service is available without cost to Linde users.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation

64 Plants UCC 154 Warehouse Stocks
General Offices: Carbide and Carbon Building
30 East 42nd Street, New York

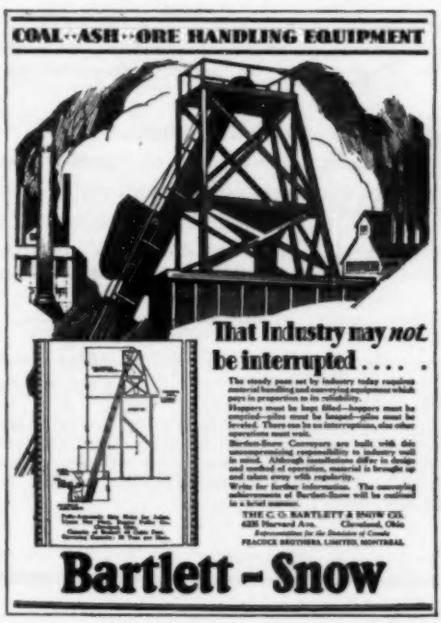
LINDE OXYGEN

··DRYERS··



STYLE C

The simple answer to DRYER *questions*



The simple answer to hundreds of dryer questions has been the correct Bartlett-Snow installation.

The fact that thirteen distinct types are standard will interest you.

At least one of these simple machines fits *your* particular tonnage, the per cent moisture of *your* material and the dryness you desire.

Bulletin No. 51 outlines facts of interest. Write for it today. In addition, a Bartlett-Snow engineer will call on you at your convenience.

THE C. O. BARTLETT & SNOW CO.
6204 Harvard Ave. Cleveland, O.
Representatives for the Dominion of Canada
PEACOCK BROTHERS, LIMITED, MONTREAL

Bartlett - Snow

VINYLITE* RESIN

THE CARBIDE AND CARBON CHEMICALS CORPORATION is pleased to announce the availability of Vinylite,* the new synthetic resin.

Many varieties of Vinylite resin are possible, each type having somewhat different characteristics but in general the properties are as follows:

COLOR — Colorless and transparent to white and opaque.

SOLUBILITY — All types of Vinylite are insoluble in water and gasoline. Certain types are insoluble in most liquids. The more common type of Vinylite is soluble in Ethylene Dichloride, Acetone, the usual esters and in the aromatic hydrocarbons.

SPECIFIC GRAVITY — Approximately 1.2.

HEAT RESISTANCE — Most types are thermoplastic at 100-150°C.

LIGHT RESISTANCE — Some types are unaffected by light. Other types when pigmented are light resistant.

WEATHER RESISTANCE — Moderate to excellent, dependent upon type of resin.

CHEMICAL RESISTANCE — Certain types are unaffected by 20% caustic or 20% sulphuric or hydrochloric acids. These same types are also unaffected by water or 95% alcohol.

Vinylite resin may be molded with or without filler. As the resin is pure white it makes possible the molding of objects in any color. These colors in either pastel or brilliant shades are as permanent as the particular pigment used.

Vinylite resin solutions may be used in the manufacture of lacquers, varnishes, paints and all types of surface coating materials. When properly formulated, these solutions can be applied with a brush or a spray gun. The film dries quickly and may be sanded or polished to a high gloss.

Other types of Vinylite may be used for the impregnation of wood, fabric, paper or other cellular material resulting in water-proof and vapor-proof surfaces. Paper may be greatly strengthened by Vinylite impregnation.

Three modifications are now available as follows:

VINYLITE 80 SOLUTION — A light yellow liquid, viscosity approximately 2.7 poises, containing 50% Vinylite 80 Resin.
Uses: Impregnating varnishes and paints.

VINYLITE 80C RESIN — A white powder insoluble in water, gasoline and alcohol. Soluble in aromatic hydrocarbons, Ethylene Dichloride, Acetone, Cellosolve Acetate and Methyl Cellosolve.
Uses: Molding and manufacture of lacquers. Impregnation.

VINYLITE 80C SOLUTION — A practically colorless solution of Vinylite 80C Resin in a solvent mixture especially designed for it. Solids content 20%, viscosity approximately 3.0 poises.

Our Technical Department has been investigating the properties and uses of Vinylite resins for over five years and will be pleased to confer with you about special applications of the Vinylite resins. For additional technical data please address:

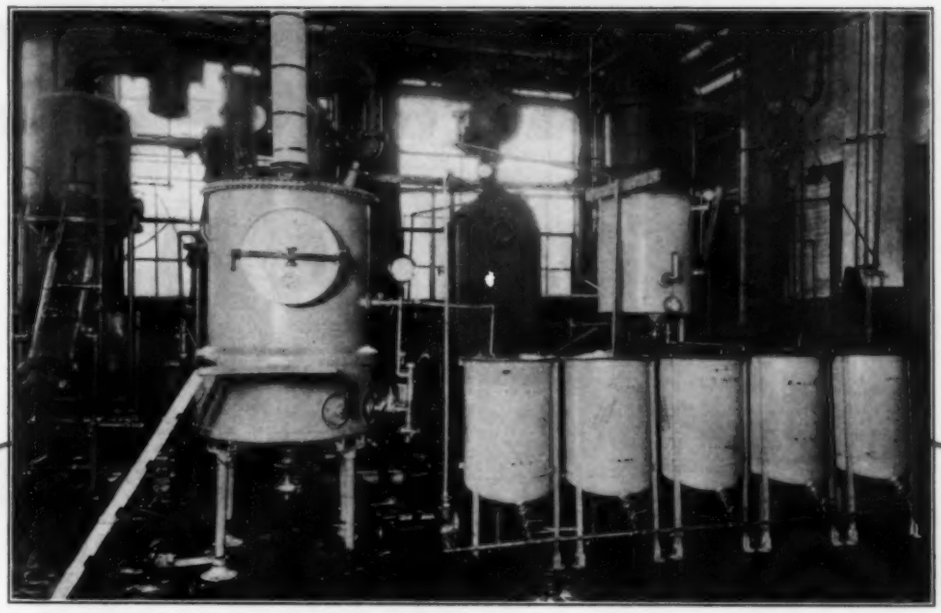
*TRADE-MARK REGISTERED

CARBIDE AND CARBON CHEMICALS CORPORATION

Carbide and Carbon Building

Thirty East Forty-second Street, New York City

Unit of Union Carbide UCC *and Carbon Corporation*



A solution ~
to many process problems

THE service of the BUFFLOVAK Research Laboratories is being profitably used with very gratifying results by many nationally known manufacturers who employ drying, evaporating or chemical processes. The illustration shows some of the special equipment used to solve a particular problem for a customer. The results brought about a decided improvement in the quality of the product and pointed the way to lower manufacturing costs and increased production.

That is but one example of how the BUFFLOVAK Research Staff with their laboratory completely equipped with every type dryer and evaporator are co-operating wholeheartedly on such problems.

Results are always definite, because the problem is worked out on a semi-plant production scale. This service offers a substantial saving in several ways. It eliminates guess-work right at the start and often shows where standard BUFFLOVAK equipment can be used with a material saving in capital investment.

Literature on various types of process equipment will be sent on request.

BUFFALO FOUNDRY & MACHINE CO.
1551 Fillmore Ave., Buffalo, N. Y.

BUFFLOVAK
Equipment

EVAPORATORS, 11 types, for chemicals, milk, sugar, pharmaceuticals, malt syrup and many food products.

DRYERS, 8 types of vacuum and atmospheric equipment for every industrial requirement.

CHEMICAL CASTINGS.

CHEMICAL PLANT EQUIPMENT.

BUFFLOVAK

Your EVAPORATOR *Problems*

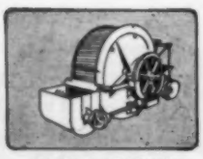
To Reduce Maintenance Costs
To Lower Steam Costs
To Reduce Condensing Water
To Stop Foaming
To Prevent Entrainment
To Reduce Salting Cycle
To Concentrate Thick Liquor
To Reduce Scale

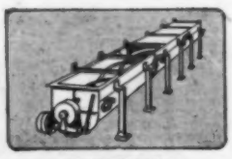
SWENSON EVAPORATOR COMPANY
15669 Lathrop Avenue, Harvey, Ill., (*Chicago Suburb*)

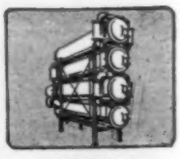
BASKET TYPE EVAPORATORS

VERTICAL TYPE EVAPORATORS

HORIZONTAL TUBE EVAPORATORS


ROTARY VACUUM FILTERS


CONTINUOUS CRYSTALLIZERS


YARYAN EVAPORATORS

The Answer

SWENSON

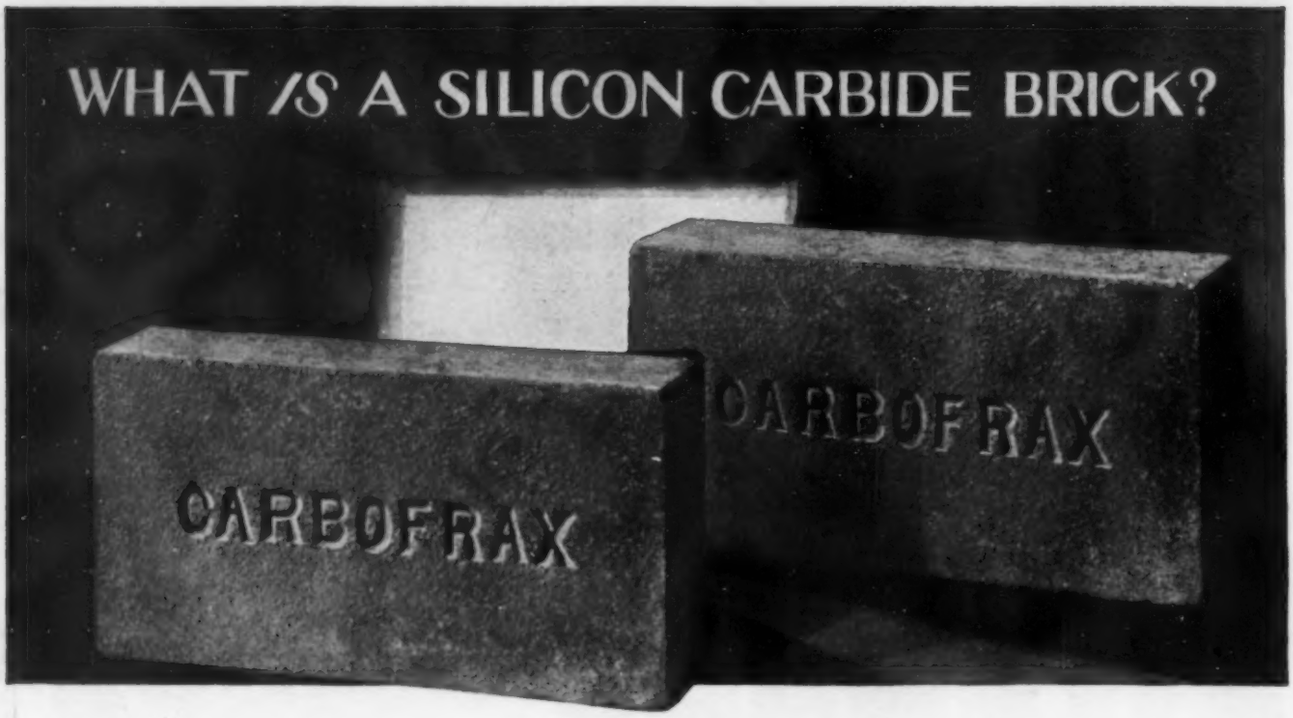
FORCED CIRCULATION EVAPORATOR

(*Patented*)

Send for Bulletin No. S-128

SWENSON

WHAT *IS* A SILICON CARBIDE BRICK?



OBVIOUSLY a silicon carbide brick is a silicon carbide brick. To live up to its title it should be all silicon carbide—no added bonding agent.

Ultimately, after being fired in the kilns, it should have from 90 to 95% silicon carbide content.

And that is what you buy and pay for in Carbofrax.

Carbofrax is a Silicon Carbide Brick in every sense of the title—in its every quality. It is the original brick of this type—and it is made from Carborundum Brand Silicon Carbide.

In Carbofrax you will have a brick that has highest refractoriness and mechanical strength—it is proof against clinker fusion, softening or spalling—a longer lived brick that costs less in the end.

CARBOFRAX

REG. U. S. PAT. OFF.

The Original Carborundum Brand Silicon Carbide Brick

SEE OUR EXHIBIT AT THE POWER SHOW

The CARBORUNDUM Company

REG. U. S. PAT. OFF.

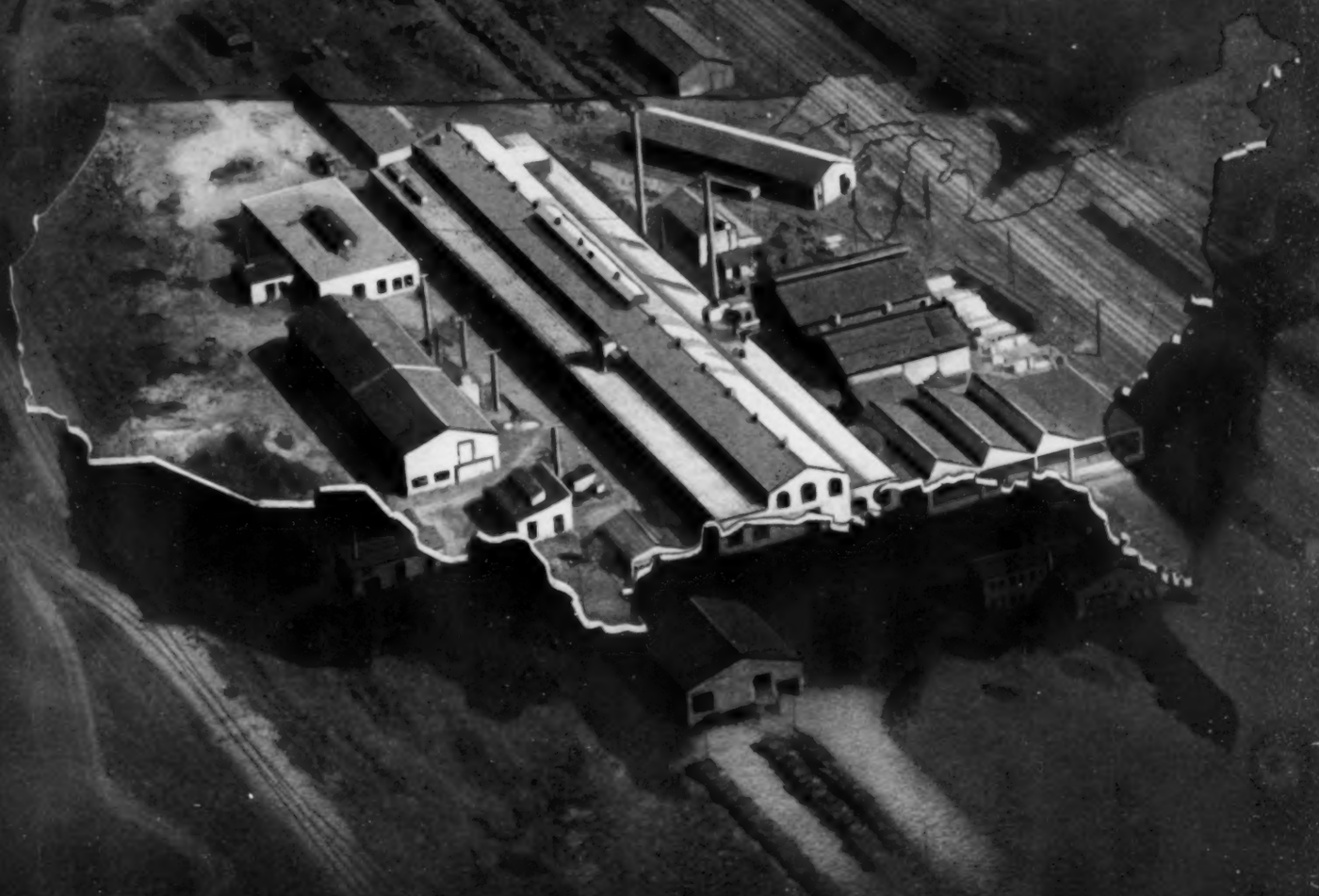
PERTH AMBOY, N. J.

PACIFIC ABRASIVE SUPPLY CO., San Francisco and Los Angeles
WILLIAMS AND WILSON, LTD., Montreal—Toronto, Canada
CHRISTY FIREBRICK COMPANY, St. Louis, Mo.
HARRISON & COMPANY, Salt Lake City, Utah
DENVER FIRECLAY CO., El Paso, Texas

(Carborundum is the Registered Trade Mark of The Carborundum Company for its Products)

DURIRON

More than the name of an acid-resistant alloy



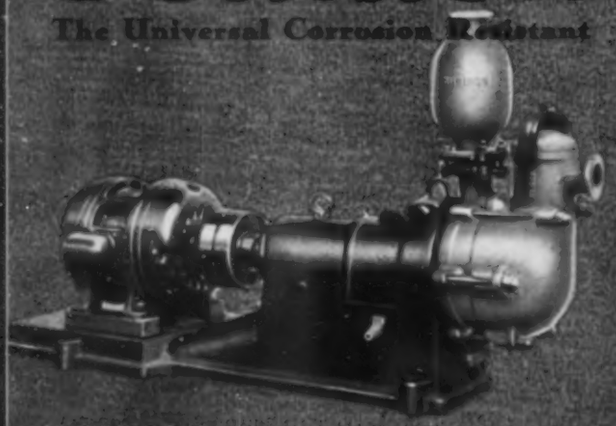
D-U-R-I-R-O-N today identifies an Organization whose experience and specialized abilities make it a preferred consultant on all problems in the creation of corrosion-resistant equipment or construction. In back of it stands a producing skill and capacity for any need.

DURIRON engineers have an exhaustive understanding of the metallurgical and mechanical possibilities of DURIRON, DURIMET and of the High Chrome Nickel Alloys. That DURIRON knowledge is yours to command for general counsel on new equipment.

See also the following page

DURIRON

The Universal Corrosion Resistant



RECIPROCATING and CENTRIFUGAL **PUMPS**

of Duriron, Durimet and Chrome Nickel Steel

Y VALVES

of Duriron, Durimet and Chrome Nickel Steel

PIPE AND FITTINGS

for Corrosive Liquids

EXHAUST FANS

for Corrosive Gases

DURIMET

A Nickel Silicon Alloy Steel

EXPANSION of The Duriron Company's plant facilities, together with the affiliation of Industrial Welded Alloys, Inc., makes it possible for one organization to assume responsibility for supplying practically all requirements in heat- and corrosion-resistant materials.

For almost universal resistance to corrosives under ordinary pressures, temperatures and service conditions—DURIRON. For higher pressures, temperatures and more universal fabrication—DURIMET or High Chrome Nickel Alloys.

Foundry and machine shop capacity for any customer-need... Welding of an expertness which has built a reputation. Fabricated sheet and plate construction, welded pipe, tanks, towers and special equipment!

Your inquiry for advice, catalogs or quotations will receive prompt and intelligent attention.

THE DURIRON COMPANY, Inc.
INDUSTRIAL WELDED ALLOYS, INC.
Divisions of Industrial Alloy Products Corporation
1054 Grand Central Terminal New York, N. Y.
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Eastern Foundry and Fabrication Plants at Newark, N. J.

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Birmingham, Boston, Buffalo, Butte, Charlotte, Chicago, Cleveland, Denver, Detroit, El Paso, Houston, Los Angeles, Memphis, Montreal, New Orleans, New York, Philadelphia, Pittsburgh, Richmond, San Francisco, St. Louis, Tacoma, Toronto, Tulsa, Vancouver.

Representatives also at:
Atlanta, Dallas, Des Moines, Kansas City, Minneapolis, Nashville, Salt Lake City, Tampa.

FABRICATED VESSELS
of Durimet or Chrome Nickel Steel

CASTINGS
of Duriron, Durimet and Chrome Nickel Steel

DURIMET
and Chrome Nickel
SHEETS & BARS
BOLTS, NUTS, ETC.

TANKS & KETTLES
of Duriron, Durimet and Chrome Nickel Alloys

ACID

Handbook No. 3

REALIZING that operating engineers are frequently handicapped by a lack of practical data we have prepared and will have ready for distribution our Handbook No. 3 of Standard Acid Tables. This handbook is intended to aid operators of Acid Plants in daily computations of yield and inventory. It will also aid many other operating executives in determinations.

CHEMICO Plants, designed, erected and turned over to you under guaranteed performance by the largest company specializing in heavy chemical plant construction.

We will be glad to send you a complimentary copy on request.

Complete plants for the manufacture and concentration of sulphuric, nitric, phosphoric and other acids . . . fertilizer and heavy chemicals.

CHEMICAL CONSTRUCTION CO.

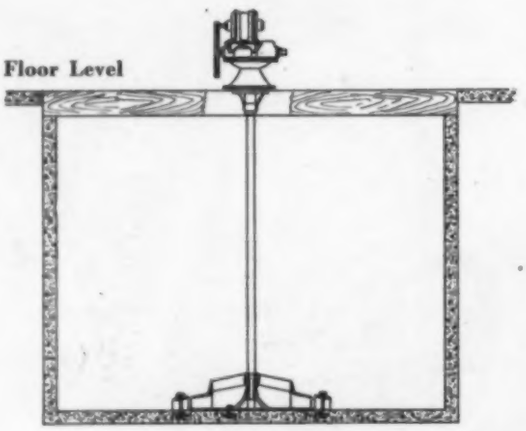
Main Office: Charlotte, N. C. **New York Office: 50 E. 42nd Street**

What the Turbo-Mixer is doing for others

CHAPTER 2

Pulp and Paper Industry

The Turbo-Mixer shows surprising versatility. It is solving almost every mixing problem in this field:



Simplex Turbo-Mixer
(Patented)

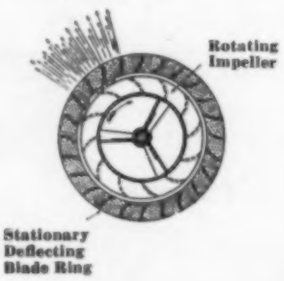
1. ***Agitation of stock.*** **The Turbo-Mixer is now being used to agitate stock up to 7½% consistency.**
2. ***Bleaching of stock.*** **Bleach tank agitation with the Turbo-Mixer is bleaching pulp quickly and economically.**
3. ***Clay mixing.***
4. ***Preparation of coatings.***
5. ***Causticizing.***
6. ***Washing of caustic muds.***
7. ***Chlorination of lime.*** **The Turbo-Mixer is widely used in bleach liquor manufacture. It induces rapid absorption of chlorine.**

The Turbo-Mixer is widely used by many of the largest pulp and paper mills because of its exceptionally thorough agitation; because it is easy to start after settling; and because it handles heavy sludges with ease.

Do you realize that, for the same power, the Turbo-Mixer circulates approximately twelve times as much material as a centrifugal pump located outside the tank?

Let our Chemical Engineers help to solve your problems.

(To be Continued)



THE TURBO-MIXER CORPORATION
233 Broadway, New York City

Trade Mark

4063

KILL FIRE WHILE IT IS YOUNG

Fire writes in red on your ledgers

You may never have had a fire. Yet tomorrow, or next week—when your plant is humming with profitable activity—fire may stealthily and quickly pay you a visit. And fire's invasion means interrupted production schedules—cancelled orders—lost customers. Fire's figures are always *red* figures.

Your plant is not protected against fire unless you can kill it *as soon as it occurs, in any kind of burning material, and in any place.*

The easiest way to be sure of correct protection is to have an American-LaFrance and Foamite engineer study your plant and recommend proper and adequate safeguards. His advice will be unbiased, for this company manufactures every recognized type of fire-fighting equipment—from one-quart extinguishers to the largest motor fire apparatus.

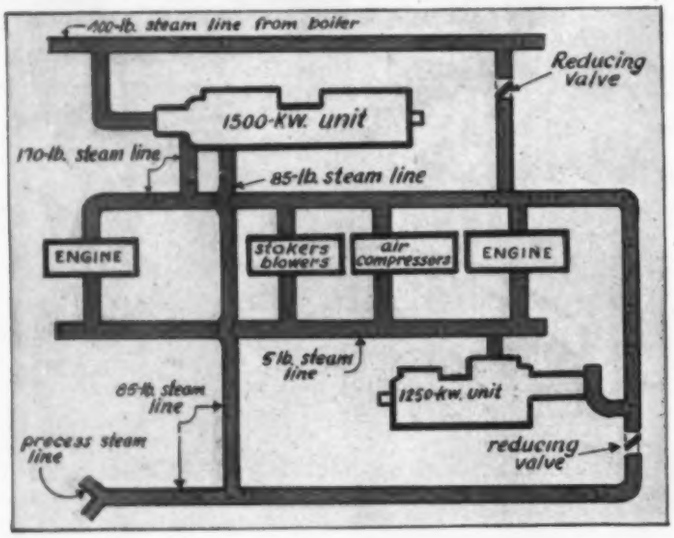
Write for an engineer to call. There is no obligation. Or our booklet "Correct Protection Against Fire" will be sent on request. American-LaFrance and Foamite Corporation, Engineers and Manufacturers, Dept. G 61, Elmira, N. Y.

AMERICAN-LAFRANCE AND FOAMITE PROTECTION

A Complete Engineering Service

For Extinguishing Fires

Cheap power furnished by Westinghouse high pressure turbine--

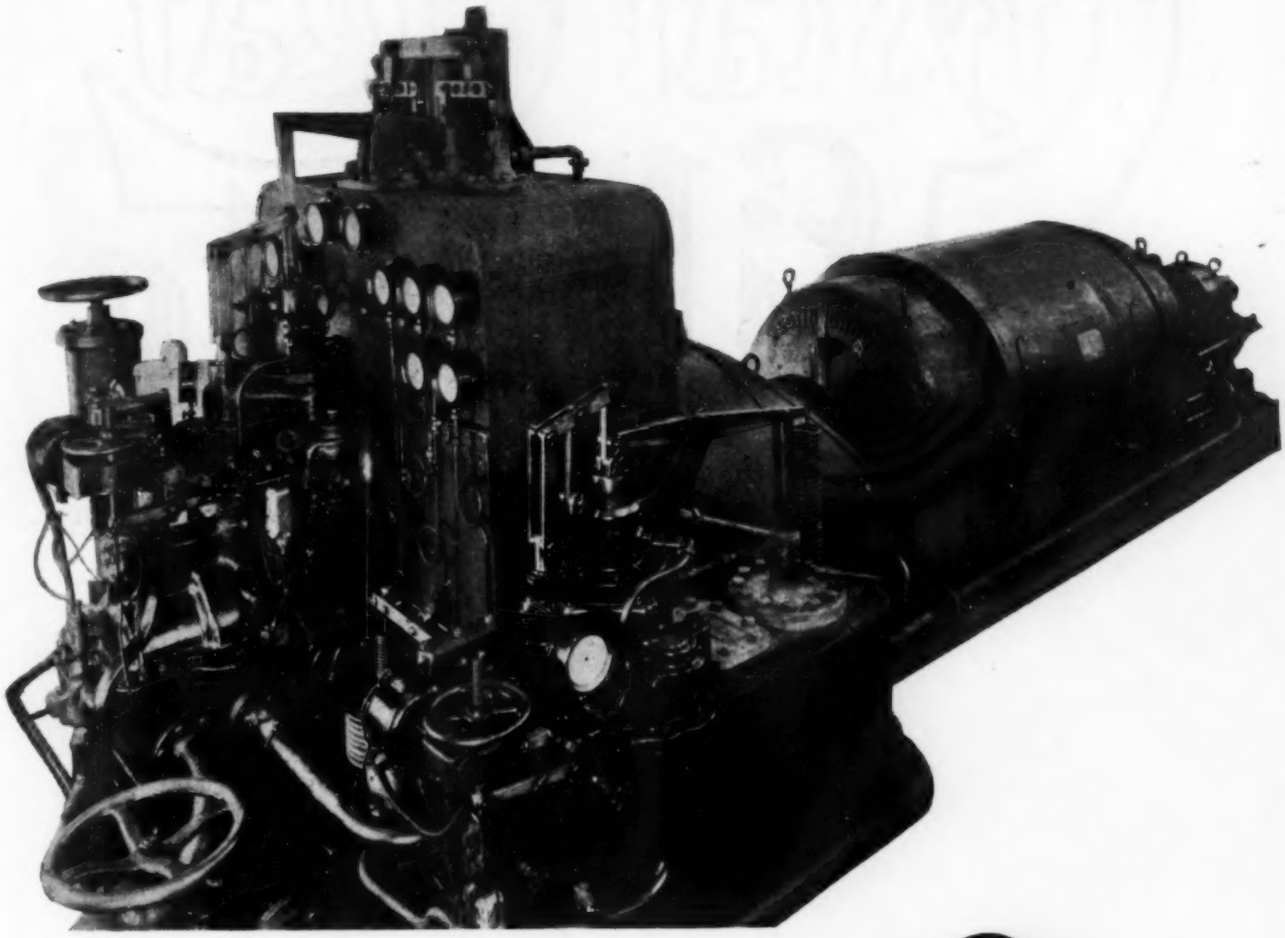


EXPANSION of the Ajax Rubber Company plant at Racine, Wisconsin, called for a large increase of steam for processing with a relatively small increase in electrical power. After a thorough study of the requirements, a 1,500-kw. Westinghouse bleeder type turbine, for operation against 85-lb. back pressure, and a 425-lb. pressure boiler were installed.

The new turbine takes steam at 400 lbs. and expands it to 170 lbs. thus producing power before part of it is bled. The remaining steam is further expanded in the low pressure element of the turbine and produces additional power before it is exhausted at 85 lbs. into the process piping system. The bled steam is used for operating non-condensing units and auxiliaries. Steam is exhausted at 5 lbs. from this equipment and used again in a 1250-kw. Westinghouse mixed pressure type turbine.

The remodeled plant provides ample process steam and generates by-product power at a cost ranging from 0.663 cents at one third plant capacity down to 0.358 cents at full load.

MODERNIZING WITH WESTINGHOUSE TURBINES



The 1500-kw. unit at the Ajax Rubber Company Plant.

Ask our nearest office for a copy of Reprint 371 which describes this installation. Helpful engineering suggestions on the proper equipment for balancing your power and process steam load are available for the asking.

WESTINGHOUSE ELECTRIC & MFG. COMPANY
SOUTH PHILADELPHIA WORKS PHILADELPHIA, PA.

SALES OFFICES AND SERVICE SHOPS IN ALL PRINCIPAL CITIES

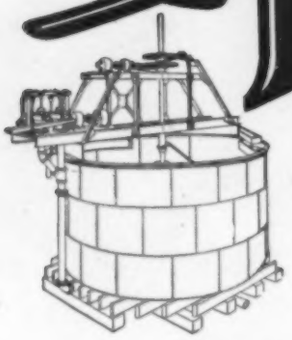
Equipment for Power Plants Includes--

Air Ejectors
Feed Water Heaters
Generators
Generator Air Coolers
Heat Exchangers
Jet and Barometric Condensers
Reduction Gears
Stokers
Surface Condensers and Auxiliaries
Turbines

Westinghouse

T 30924-A

a Crystal Clear Filtrate



A positive but inexpensive method of obtaining crystal clear liquids and solutions is offered in the Hardinge Sand Filter.

Following is a list of a few of the solutions now being clarified in Hardinge Filter installations:

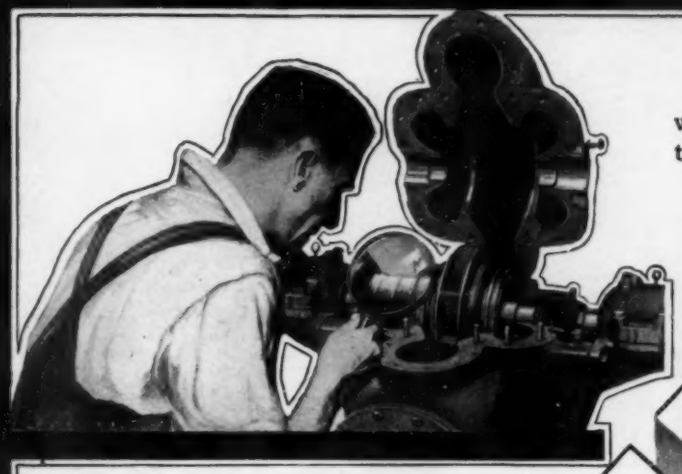
Saturated Brine
Caustic Soda Liquor
Cane Sugar Juice
Trona Liquor
Gasoline
Oil
Cyanide Solution
Boiler Feed Water
Various Acid Solutions

Write for Information

HARDINGE COMPANY
YORK, PENNSYLVANIA
BRANCH OFFICES
NEW YORK, N.Y., 122 EAST 42nd STREET
SALT LAKE CITY UTAH: CONTINENTAL BANK BLDG.

Hardinge

Conical Ball, Pebble and Rod Mills; Ruggles-Coles, Dryers, Thickeners, Clarifiers



PACK *the fluid end of the pump* with a packing that retains its lubricant against the washing out tendency of the fluid pumped. The following packings meet perfectly the various conditions specified:

PELRO PACKING

for

GASOLINE
NAPHTHA
KEROSENE
AMYL ACETATE (Banana Oil)
BUTYL ACETATE
ACETONE
BENZINE (Benzol)
TOLUENE (Toluol)
XYLENE (Xylol)
TURPENTINE
MINERAL SPIRITS
ETHYL ACETATE (Acetic ether)

PALMETTO PACKING

for

STEAM
(High pressure, superheat)
•
Compressed Air
•
ACIDS
OXALIC
PALMITIC
STEARIC
TANNIC
BENZOIC
BORIC
CITRIC
OLEIC
TARTARIC
ALKALIES
BORAX
SODIUM SULPHITE
MISCELLANEOUS
SODIUM BICARBONATE

CUTNO PACKING

for

ACIDS
Hydrochloric (Muriatic)
Acetic (Glacial and dilute)
Lactic
Nitric
Sulphuric (Oil of Vitriol)
Sulphurous
Phosphoric
STRONG ALKALIES
Sodium Hydroxide (Caustic Soda)
Potassium Hydroxide (Caustic Potash)
Sodium Carbonate (Soda Ash)
Potassium Carbonate (Potash)
Ammonia (Anhydrous and dilute)
Lime
ALKALINE SALTS
Borax
Sodium Sulphite
Sodium Cyanide
Potassium Cyanide
Sodium Sulphide
Potassium Sulphide
Sodium Silicate (Waterglass)
Tri-sodium Phosphate
Sodium Bisulphite
ORGANIC SOLVENTS
Methyl Alcohol* (Wood alcohol)
Ethyl Alcohol* (Grain alcohol)
MISCELLANEOUS
Chlorine
Bleach Liquor
Bromine
Lime Sulphur
Salt Cake
Alum
Hydrogen Peroxide
Creosote (Coal Tar)
* Concentrated and dilute

PALCO SQUARE PLAITED PACKING

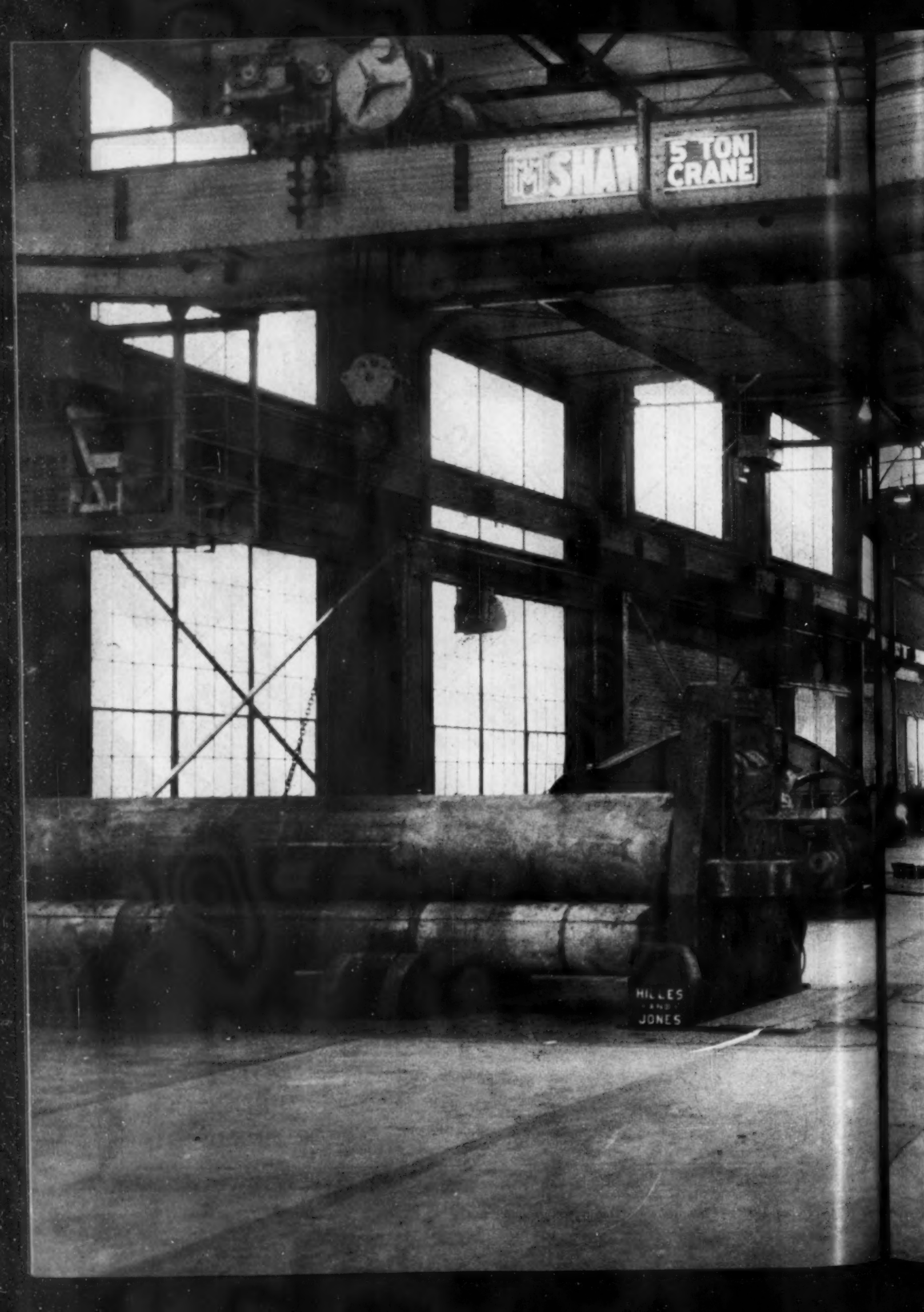
for

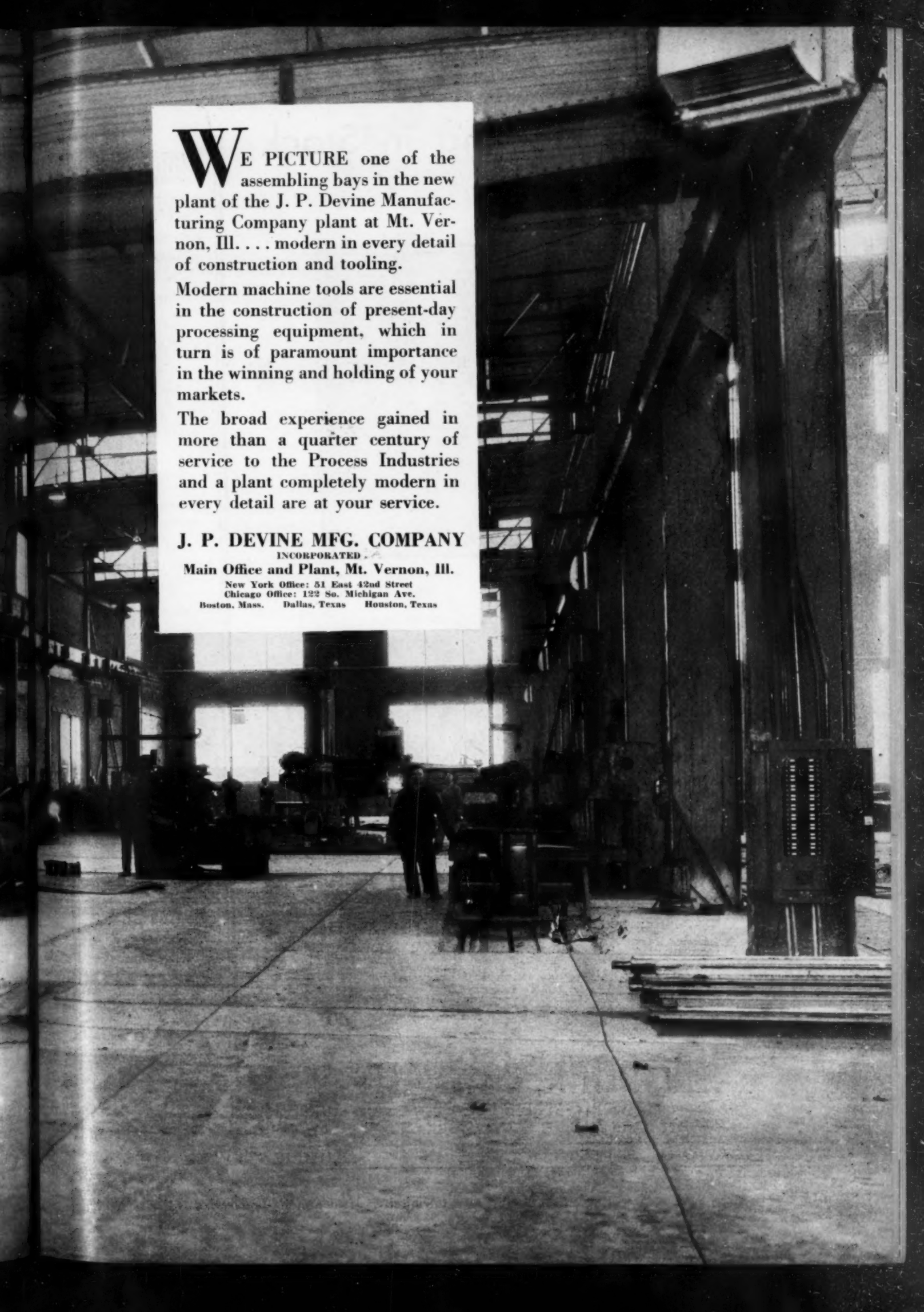
WATER
(Hot and cold)
•
CALCIUM BRINE
•
Centrifugal and Reciprocating PUMPS
•
Has high tensile strength and carries such an abundance of lubricant that shaft friction is avoided.

To prove our claims for long satisfactory service, let us send you without charge or obligation working samples of the above packings to test under your own conditions. State condition of service and size packing desired.

GREENE, TWEED & CO.

Sole Manufacturers 109 Duane St., New York


SHAW
5 TON
CRANE
HILLES
AND
JONES



WE PICTURE one of the assembling bays in the new plant of the J. P. Devine Manufacturing Company plant at Mt. Vernon, Ill. . . . modern in every detail of construction and tooling.

Modern machine tools are essential in the construction of present-day processing equipment, which in turn is of paramount importance in the winning and holding of your markets.

The broad experience gained in more than a quarter century of service to the Process Industries and a plant completely modern in every detail are at your service.

J. P. DEVINE MFG. COMPANY
INCORPORATED
Main Office and Plant, Mt. Vernon, Ill.
New York Office: 51 East 42nd Street
Chicago Office: 122 So. Michigan Ave.
Boston, Mass. Dallas, Texas Houston, Texas

We Have Nothing in Stock but **Experience**

A view of our shops showing Classifiers assembled, before shipment.

¶ The Dorr Company keeps no equipment in stock — our only stock on hand is a thorough knowledge of wet-material handling problems, and of machines and methods best suited to solving them. ¶ Equipment for each order is made up after the order is received . . . custom built to your own requirements, in our specially equipped shops. ¶ Before shipment, each machine is assembled, as completely as possible, and given a trial run and preliminary inspection in the shops. **Final** mechanical inspection is made by Dorr Service Engineers after the equipment is erected in the field. ¶ **You** know that you are getting a carefully manufactured, thoroughly inspected machine specially built to your requirements. **We** know that we can stand behind the machine, confident of its ability to do the work for which it is installed.

Bulletin No. 7071 describes Dorr Equipment and Services. Write to our nearest office for a copy.

THE DORR COMPANY

ENGINEERS

247 PARK AVENUE NEW YORK CITY

INVESTIGATION TESTS DESIGN EQUIPMENT

DORRCO

One of a series of advertisements devoted to the facilities offered to Industry by the Dorr Company

Denver
1009 17th Street

Chicago
333 N. Michigan Ave.

Los Angeles
108 West Sixth Street

Wilkes-Barre
536 Miners Bank Bldg.

Atlanta
1503 Candler Bldg.

Joplin
319 Joplin Nat. Bk. Bldg

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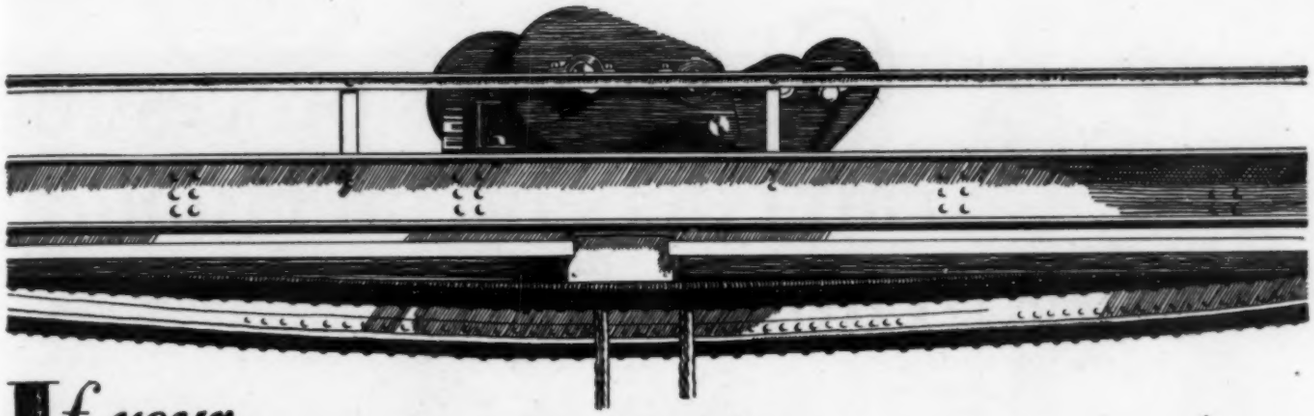
Andrews & George
Tokio



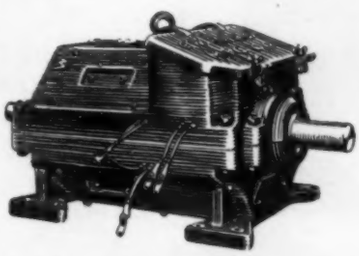
If your PRODUCTION demands a Crane

THAT crane is important. Stop it . . . and you have a traffic jam.

Cranes look complicated but they are really very simple and seldom cause trouble if given ordinary care. Most working parts are exposed and open to periodic inspection. But within the motor you must take for granted the construction sealed inside the housing. Your only safeguard is the name plate.

If it reads Crocker-Wheeler, you know that the conditions under which the crane was planned to operate were studied before the motor was sold. You know the motor was not cheapened to meet price competition. You can rest assured that everything humanly possible was done to produce a motor installation that would not fail.

Your Crane is too important a part of your plant to take casually. Look for the name plate on the motor.



Birmingham
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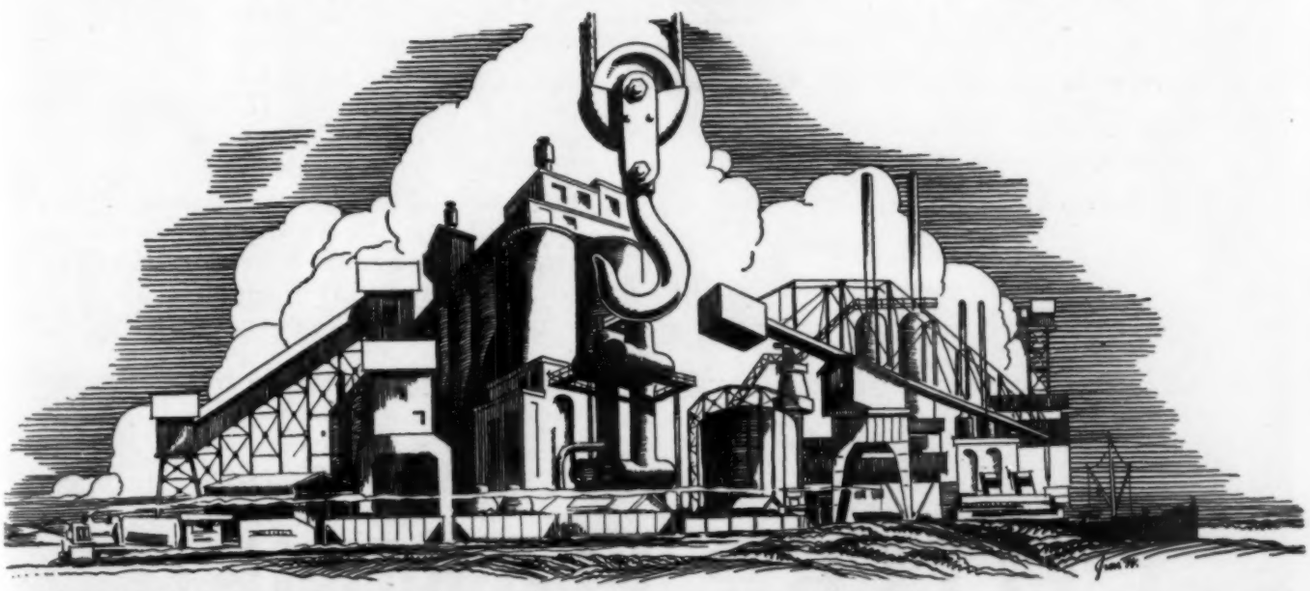
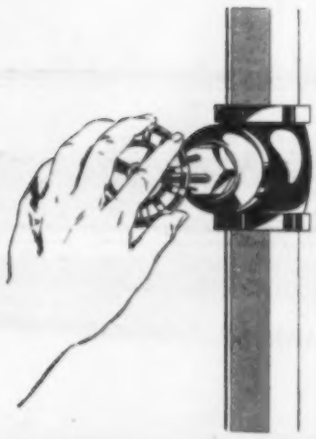
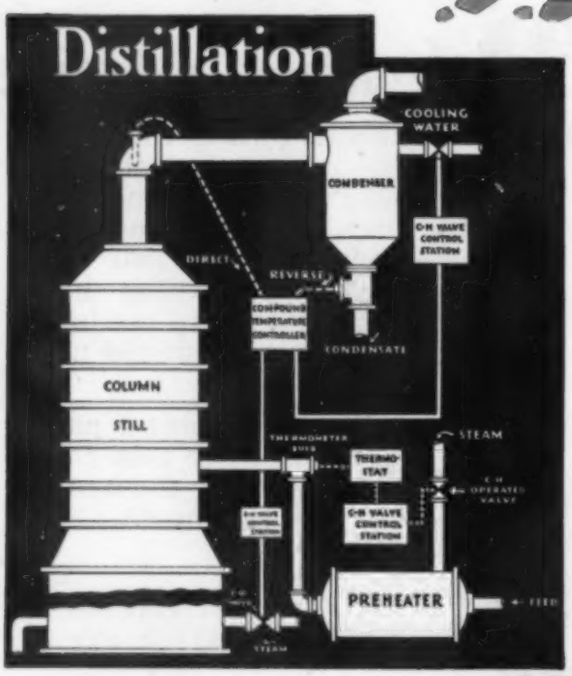
CROCKER-WHEELER
ELECTRIC MFG. CO.
Ampere, N. J.



CROCKER WHEELER



Continuous processing can't depend on *Human Hands* and *Feet*



DESPITE a beautiful plant layout... despite big money spent on all the latest effects, autoclaves, agitators or what not... full efficiency cannot prevail if the "continuous" part of your processes, the connecting and controlling valves are still left to manual operation and human fallibility.

Take the "hands and feet" off your valves. Valves should be under full automatic control. There's money in it and there's a way to do it: limit, pressure, float switches—any device capable of recording a changed condition... plus low-cost C-H Ao Valve Control Units for 1″ to 6″ valves.

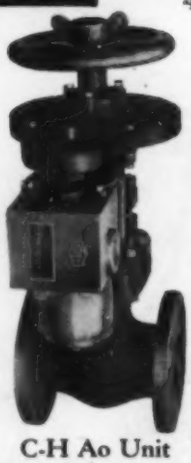
C-H Valve Control helps continuous production by—

1. Permitting complete automatic, remote control of processes.
2. Supplying more exact control than does manual operation.
3. Allowing greater handling speed of materials.
4. Guarding against spoilage and variations from standard quality.
5. Saving time and steps.
6. Reducing labor costs.

The operation of C-H Control is always positive. The famous C-H "unseating blow" assures the starting of any sticky valve. C-H Ao Control Units are always on the job, never go to sleep. Their low cost recommends the application of the Ao Units wherever accurate, speedy and safe operation of valves is advantageous. Send for complete information on the subject.

C-H *Valve Control Used* *in* DISTILLATION

Where temperatures must be infallibly preserved, where several variables must be taken into consideration, C-H Operating Units furnish "beyond-human" control. The schematic layout shown above illustrates how simply C-H Units may be applied. A series of thermostats, an equal number of C-H Control Units...and there will be no delays to upset production schedules, no "mistakes" to throw quality off from standard. In a short time, C-H Control more than pays its way.



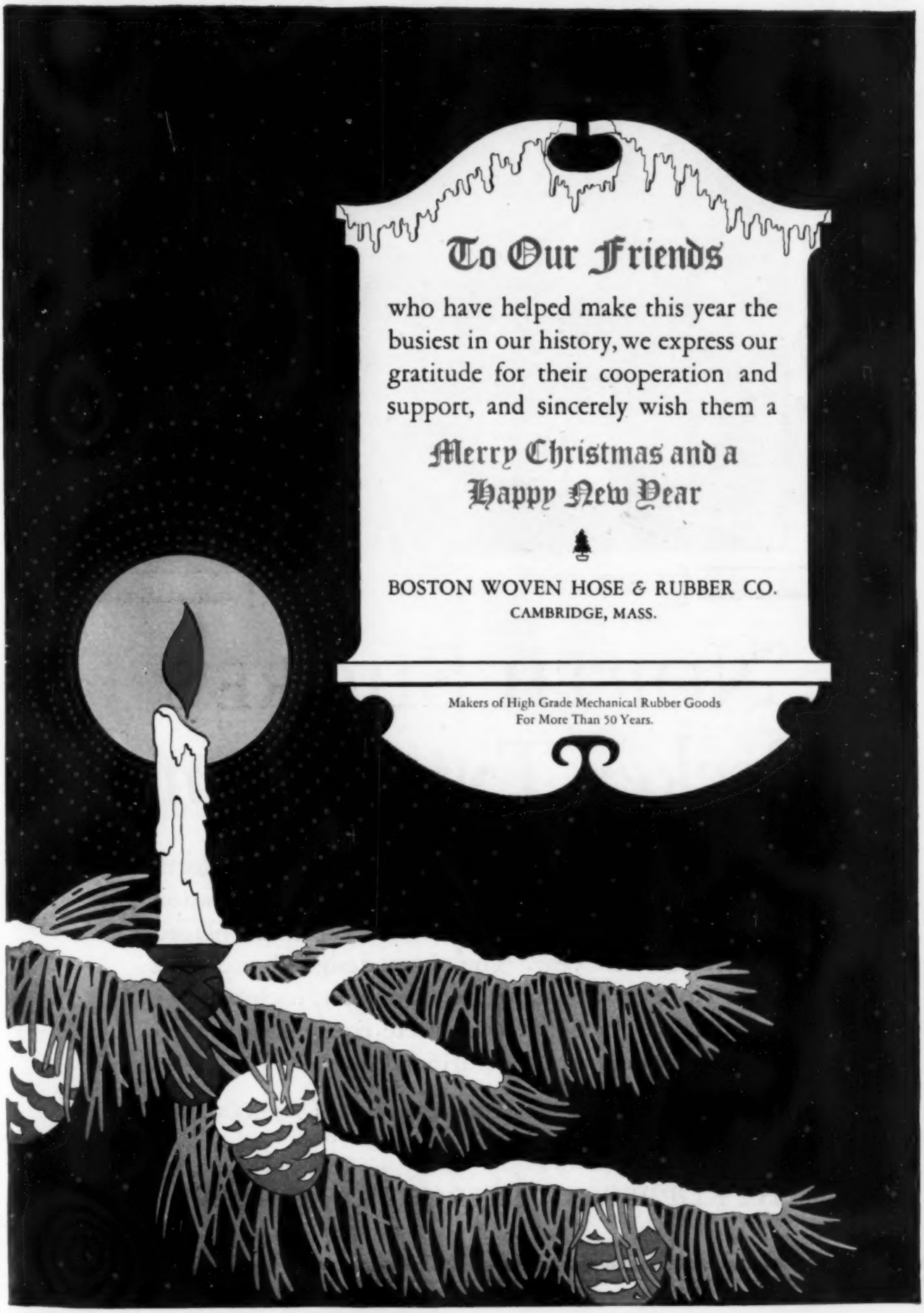
C-H Ao Unit
for 1″ to 6″ Valves—of any make
Your valve manufacturer can furnish valves with units mounted complete.

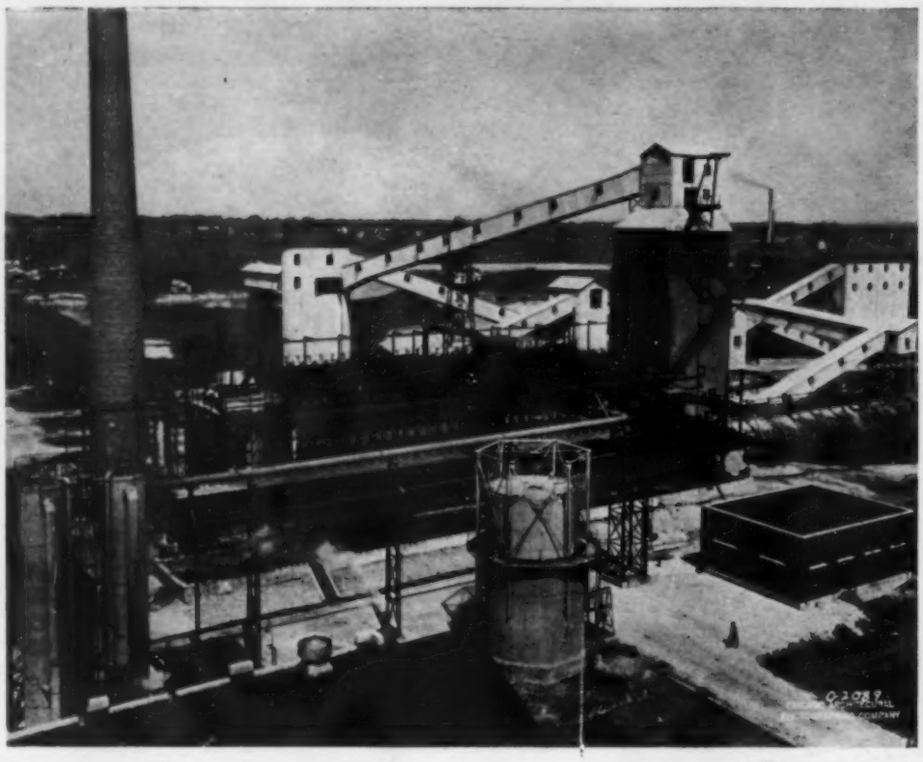
CUTLER-HAMMER, Inc.
Pioneer Manufacturers of Electric Control Apparatus
1275 St. Paul Avenue
MILWAUKEE, WISCONSIN

CUTLER HAMMER

Motor Driven Valve Control System

(8709)


To Our Friends
who have helped make this year the busiest in our history, we express our gratitude for their cooperation and support, and sincerely wish them a
Merry Christmas and a Happy New Year
BOSTON WOVEN HOSE & RUBBER CO.
CAMBRIDGE, MASS.
Makers of High Grade Mechanical Rubber Goods
For More Than 50 Years.



BY-PRODUCT COKE AND GAS PLANT OF NORTH SHORE COKE AND CHEMICAL COMPANY AT WAUKEGAN, ILLINOIS

NORTH SHORE'S *Becker Type Ovens*

The By-Product Coke and Gas Plant of the North Shore Coke and Chemical Company, an organization headed by Mr. Wm. A. Baehr of Chicago, was placed in operation this year. The plant, designed and built by the Koppers Construction Company, including 31 Becker Type Ovens and complete equipment for by-product recovery and gas purification.

This installation has a normal capacity of 165,000 tons of coal per year.

THE KOPPERS CONSTRUCTION COMPANY

CHICAGO
PITTSBURGH
NEW YORK

Shop view of one of the Barnstead installations serving the Standard Oil Company. This distilled water outfit consists of a steam-heated Barnstead Automatic Water Still of 25 gallons hourly distilled water capacity; a standard Barnstead Distilled Water Storage Tank, All-Metal Cylindrical type, 100 gallons capacity; and two Barnstead Distilled Water Storage Tanks each of 10 gallons capacity and each equipped with heating coil.

■

"NEARLY EVERYBODY USES THE BARNSTEAD"

T. M. REG. U. S. Pat. Off.

Barnstead Water-Distilling Equipment—operated either by manually starting and stopping, or without any attendance whatever as in the case of the Barnstead Full-Automatic Distilled Water System—is employed by the leaders throughout the Process Industries. It is not uncommon for a large corporation to utilize 25 or more Barnstead Automatic Water Stills. Many have "standardized" on the use of the "Barnstead" in all plants.

For a half-century, the purity of Barnstead-distilled water has been a recognized standard for chemical purity among prominent Laboratory and Scientific authorities. The dependability and ease of the trouble-free operation of Barnstead Automatic Water Stills has materially aided both Research and Plant-Control laboratories and Industrial processes. Time is saved, accuracy of determinations is ensured, delays and spoilage are avoided. The strictly "corrosion-resistant" construction means that, with ordinary care, a "Barnstead" will last indefinitely. Many have been in continuous use over a period of 20 years. Genuine, *lasting* economy is provided.

Write for complimentary copy of the Barnstead Distilled Water Handbook. Or, if you are in present need of equipment, ask our Engineering Department for the proper recommendations. State the approximate quantity of distilled water you will require daily and the heating methods you have available: high-pressure steam, gas, electricity, or kerosene.

BARNSTEAD STILL AND STERILIZER CO., INC.

Original and Sole Manufacturers of the "genuine" Barnstead Still

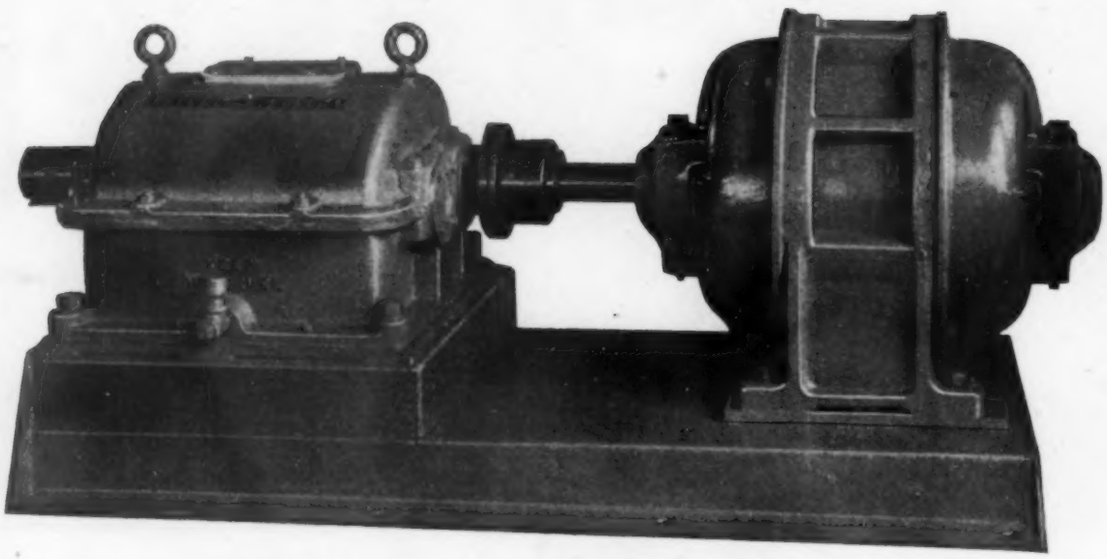
4 Lanesville Terrace, Forest Hills, Boston, Mass.

BARNSTEAD WATER* STILLS

for (1) PROCESS—(2) LABORATORY—(3) STORAGE BATTERY SERVICE

**Only Distilled Water is Chemically Pure*

From Stock



LINK-BELT Herringbone Speed Reducers

(Sykes tooth form)

Popular sizes can now be shipped in 24 hours —one day after receipt of order.

The increasing demand for Link-Belt Speed Reducers has made it possible for us to carry reducers in stock.

This time saving improvement marks another forward step in Link-Belt Service. Send for catalog No. 815, containing particulars and list prices.

LINK-BELT COMPANY 3826

Leading Manufacturers of Elevating, Conveying, and Power Transmission Chains and Machinery

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Charlotte, N. C. 909 Commercial Bank Bldg.
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Cleveland - - - - 527 Rockefeller Bldg.
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Continental-Diamond Fibre Company

Newark, Delaware

July 31, 1929.

Fletcher Works, Inc.
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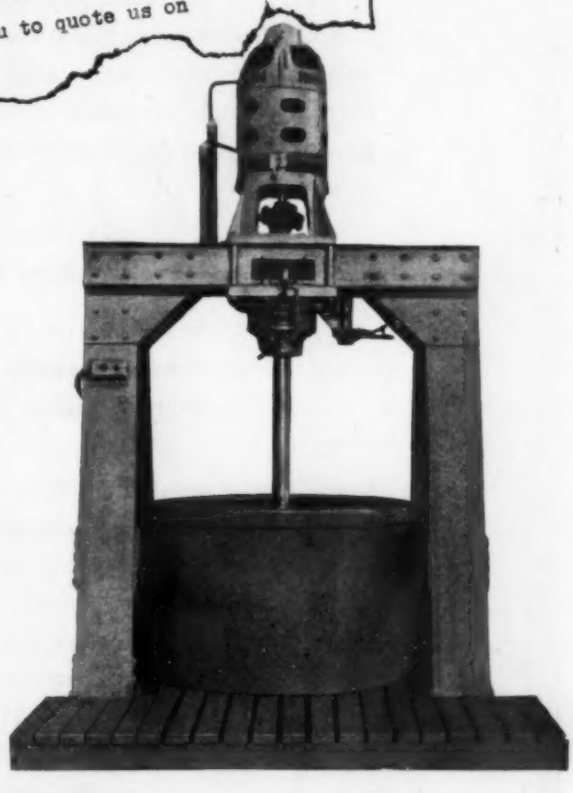
Philadelphia, Pa.

Gentlemen:

You will, no doubt, be glad to learn that the 40" suspended centrifugal which you furnished us on our purchase order #0250, April 1927, has been giving excellent satisfaction. It is now operating continuously night and day under severe conditions and has so far given no trouble at any time.

We are asking you to quote us on a duplicate installation.



2½ years of satisfactory service

brought a duplicate order for another Fletcher

Here is an actual case of FLETCHER PERFORMANCE at the plant of the Continental-Diamond Fibre Co., Newark, Delaware.

Fletcher Centrifugals have kept step with the most advanced methods and new processes in the chemical and allied industries.

Among the variety of Fletcher designs, range of sizes, diversity of drives there is a Fletcher Centrifugal that is exactly suited to your process and your plant.

Our Research Department will be glad to test samples of your material and to give authoritative advice on the type of Fletcher Centrifugal that will give you best results.

We are in Chemical Engineering Catalog

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Get the facts and you'll get a FLETCHER

MIXED AMYL CHLORIDES

THE attention of the chemical industry is called to the fact that the monochlor-pentanes are available in commercial quantities at reasonable prices. The principal use of these amyl chlorides at the present time is in the manufacture of amyl alcohols but they are gradually finding uses in other fields where they supply a convenient source of the amyl radical. They are finding a variety of uses in this way in the preparation of pharmaceuticals. They are excellent wax, fat, oil and tar solvents and can be used as extracting agents for materials of this kind. These chlorpentanes enter into the usual reactions of the halogen derivatives to form such compounds as amyl benzene by combining amyl chloride and benzene in the presence of aluminum chloride.

The mixed chlorides as produced commercially have the following characteristics:

Color	Water white
Specific Gravity at 20°C	0.860 to 0.880
Boiling Range	85°C to 107°C

Some of the special fractions of this material can be supplied if desired. Samples of these amyl chlorides and any information available will be supplied upon request.

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The SHARPLES SOLVENTS *Corp.*

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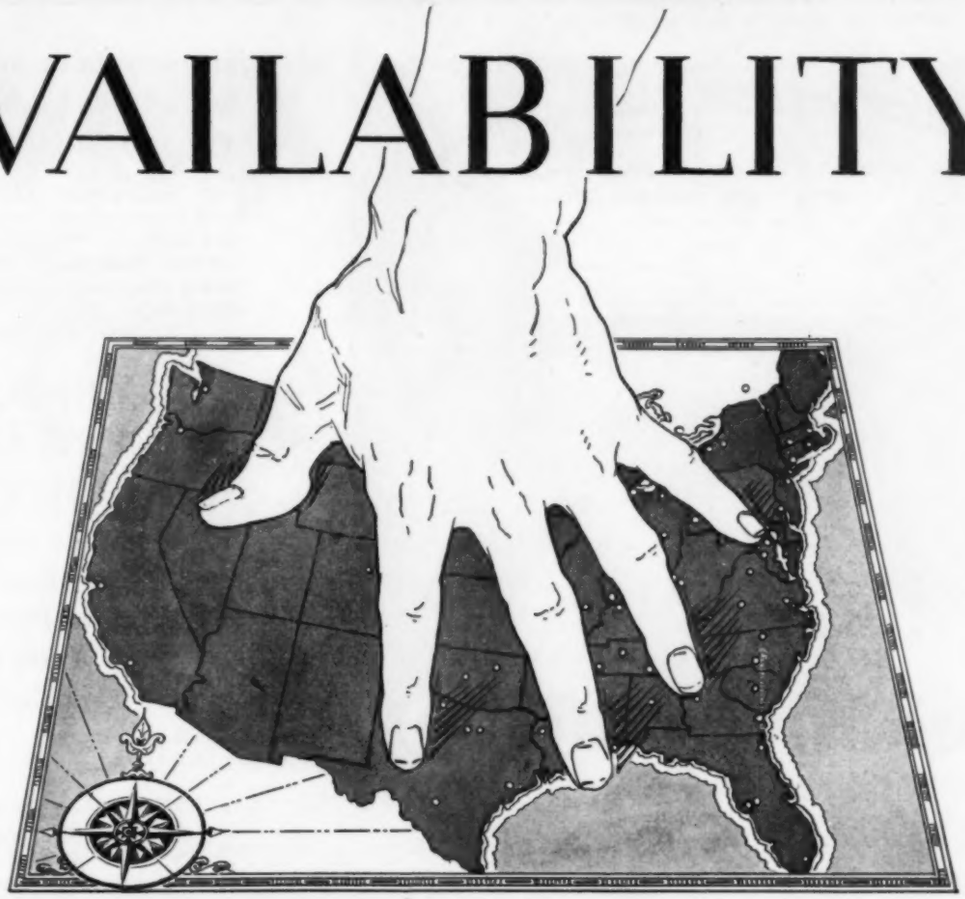
INDUSTRY'S RAW MATERIALS

AVAILABILITY



THE real value of a distributing organization can be measured by how well it serves the needs of individual customers. In a word, availability to all purchasers must be assured. The location of Mathieson plants near the principal consuming centers insures prompt shipments, regardless of quantity, while a nation-wide chain of a hundred warehouse stocks serves the needs of Mathieson customers requiring limited quantities on short notice. This distributing service is an essential factor in the Mathieson policy of guaranteeing quality and satisfaction to every purchaser of Mathieson Chemicals.

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Liquid Chlorine
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Bicarbonate of Soda
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The MATHIESON ALKALI WORKS *(Inc.)*
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Works: Niagara Falls, N.Y. Saltville, Va.
Warehouse Stocks at all Distributing Centers

MATHIESON ALKALI-CHLORINE CHEMICALS

MATHIESON CHEMICALS

AMER SOL "Quality Control Bulletin" No. 9

High Grade AMER SOL Industrial ALCOHOL
Higher Than U.S.P. Specifications
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If your formula or process requires Alcohol of the highest quality ... we invite your inquiries and orders.

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with Quartz Quality Silicate of Soda

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Silicate of soda° also serves a purpose in concrete road building. When applied to freshly laid concrete roads, it is an effective curing agent.

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Send for our bulletin No. 34 for details of these various treatments for concrete with Concrete Special Silicate of Soda. °Concrete Special Silicate of Soda.

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Aero Brand Tri Sodium Phosphate is accurately screened, carefully cured and shipped in paper-lined, non-sifting drums, kegs and barrels.

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The Cottrell Process not only raises the efficiency of operation by removing dust and "fume" from the smoke and air of your plant, but also salvages particles of value.

Operation is simple, and the installation of equipment soon pays for itself.

For Cement Mills the new type of Graded Resistance Electrode construction offers the advantages of the Process at still lower cost.

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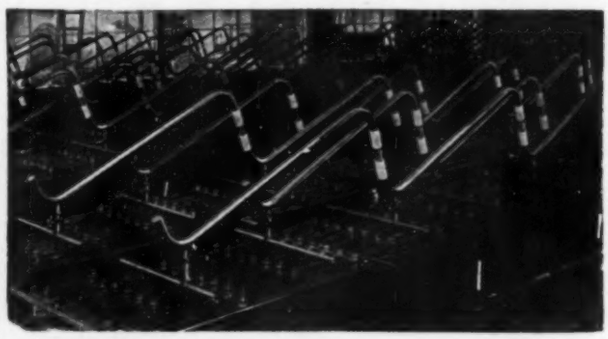
for high purity and low cost production



Installation of 50 No. 13 "EYEOSEE" Knowles generators at a Pennsylvania Steel Plant, where both the hydrogen and oxygen are used for cutting purposes.

Normal 24-hr. productive capacity at 2,000 amperes, 20,000 cu.ft. of 99.75% pure oxygen and 40,000 cu.ft. of 99.95% pure hydrogen. Can be operated at 3000 amperes at slightly higher voltage to produce 50% more of each gas.

Our experience as American Manufacturers and Distributors enables us to recommend these plants unqualifiedly.

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Why wait until the need is *urgent?* Today there is an industry that helps *all* industry to meet the vital needs of the present, and to anticipate those of the future. This new factor in business is tremendously important, yet to learn about it all you need to do is mail the coupon shown below!

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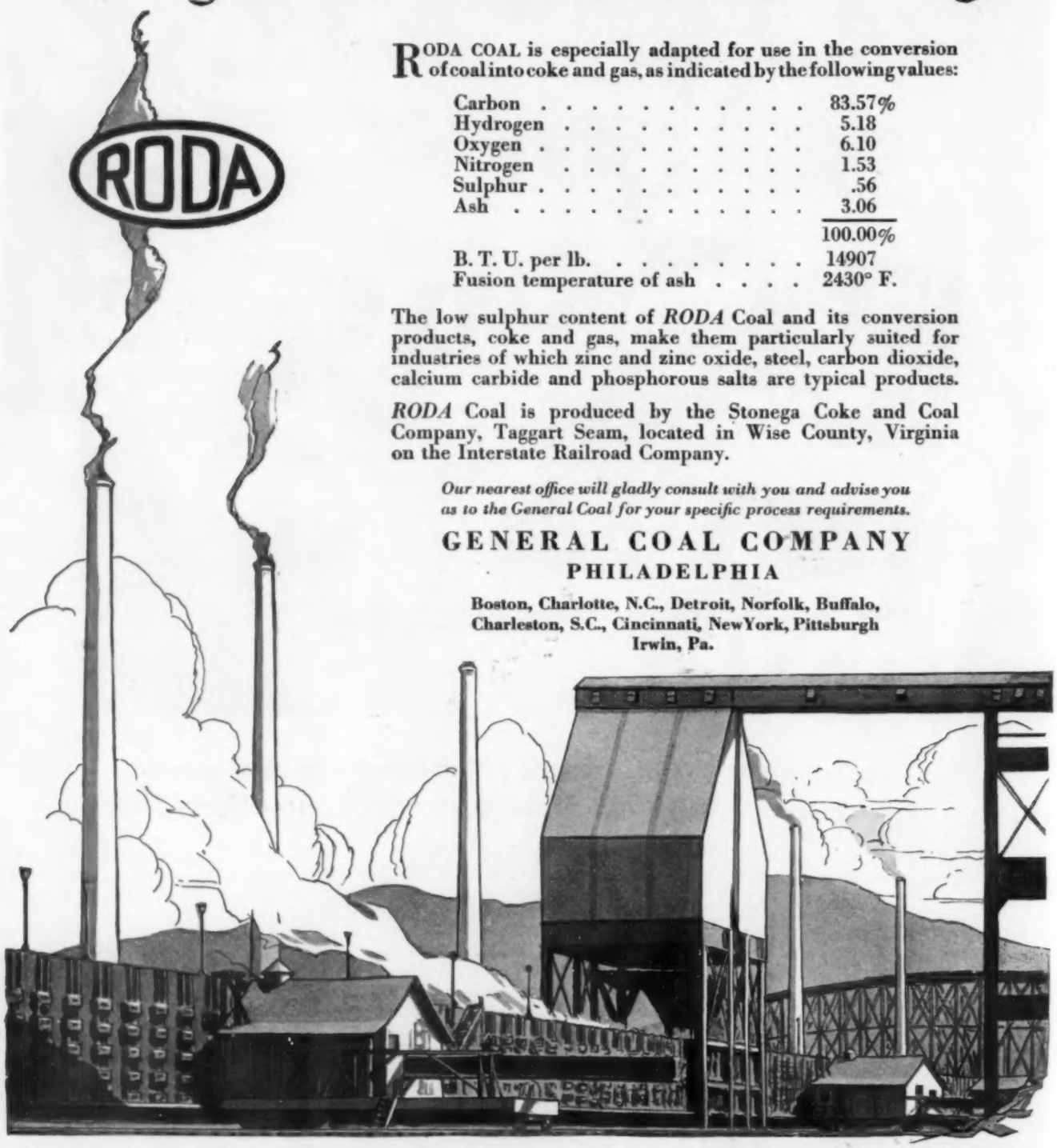
for conversion into coke or gas



RODA COAL is especially adapted for use in the conversion of coal into coke and gas, as indicated by the following values:

Carbon	83.57%
Hydrogen	5.18
Oxygen	6.10
Nitrogen	1.53
Sulphur	.56
Ash	3.06
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Fusion temperature of ash	2430° F.

The low sulphur content of *RODA* Coal and its conversion products, coke and gas, make them particularly suited for industries of which zinc and zinc oxide, steel, carbon dioxide, calcium carbide and phosphorous salts are typical products.

RODA Coal is produced by the Stonega Coke and Coal Company, Taggart Seam, located in Wise County, Virginia on the Interstate Railroad Company.

Our nearest office will gladly consult with you and advise you as to the General Coal for your specific process requirements.

GENERAL COAL COMPANY
PHILADELPHIA

Boston, Charlotte, N.C., Detroit, Norfolk, Buffalo, Charleston, S.C., Cincinnati, New York, Pittsburgh Irwin, Pa.

GENERAL COAL

Totem Post in New Caledonia—from photo furnished by our Mine Manager.

Totems

In New Caledonia every native has a "totem." It may be a bird, a beast,—even some kind of a tree or fruit. Whatever it is, the native reveres and protects it to the best of his ability, and has implicit confidence that in some mysterious manner it will in turn protect and help him.

For three-quarters of a century, it might be said that *our* totem has been the development of Chromium Salts to the highest standards of purity and excellence. That the idea has worked successfuly both ways is evidenced by the fact that we are now the largest producers of Bichromates in the World; and the only concern controlling every step of the process from mine to finished product.

With the advent and rapid development of Chromium plating we have also become important producers of Chromic Acid.

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Bichromate of Soda
Bichromate of Potash
Oxalic Acid

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NEW YORK N.Y.

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(99½%)

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Peerless Special Chemical
WHITE
LIME

If your process calls for the use of high calcium lime, it will pay you to investigate the merits of PEERLESS.

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PULVERIZED LIME
HYDRATED LIME
LUMP LIMESTONE
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THE specifying of chemicals and other raw materials starts well within the plant . . . not at the front office.

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Chem. & Met. for Equipment . . . Raw Materials, too!

The *New* Requirements Point to

METHANOL

Are your customers demanding higher purities, quicker deliveries, lower costs? Is the answer in your case — a cheaper, quicker process or some short-cut to higher production? Are your competitors putting themselves in a better position to meet the new requirements of industry? Can you use pure Methanol to advantage in some process?

Today it is the farsighted manufacturers who are considering these questions — tomorrow or a year from now they may have important advantages because they early recognized today's opportunities.

Pure synthetic Methanol is assuming a new importance in the chemical process industries. This development is significant for it will bring important replacements and economies in the manufacture of a multitude of products. As a raw material used in the manufacture of organic chemicals, as a commercial solvent and anti-freeze, Methanol is well-known — but its wider future applications are still buried or just coming to light in a thousand plants throughout the country. Today it will pay to think in terms of pure Methanol.

We invite your inquiries.

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Consult Liquids' Engineers on the use of CO_2 GAS

in the processing of your product

Liquid engineers and chemists will be glad to assist you in the development of any process involving the use of CO_2 Gas. Our engineering staff composed of experts, with a vast experience in the application of this gas to modern manufacturing and scientific uses, is available for consultation whether you are already using CO_2 or contemplating using it.

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Saf-Dry CO_2 Gas (pronounced safe-dry) is especially prepared for refrigeration plants only. This special preparation assures freedom from moisture.

***Liquid's* is the largest CO_2 manufacturing and distributing organization in the world—36 distributing points—One near you.**

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Synthetic Glacial Acetic Acid

"One of the features in the market"

Niacet offers a product of high purity, water white color, uniform strength and free from all impurities.

Another product—a Superior Grade of Acetic Acid of purest quality suitable for U.S.P., edible and fine chemical uses is also ready.

Shipments made in aluminum drums, net weights 100 and 900 lbs. and tank cars of 80,000 lb. capacity.

Write Niacet for samples and specifications.

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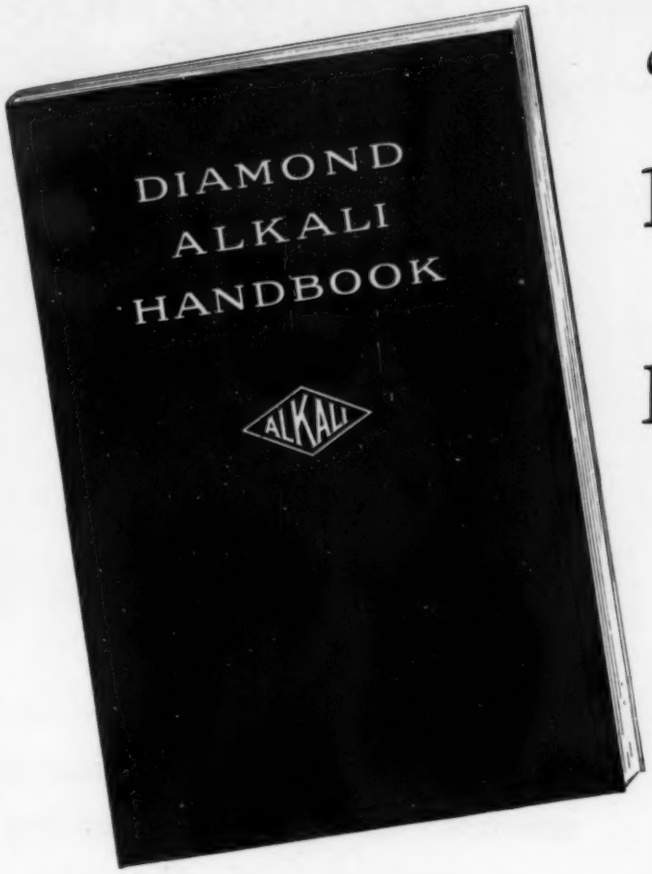

The New

DIAMOND ALKALI HANDBOOK

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The Book that Turns Practical Questions Into Profitable Answers —

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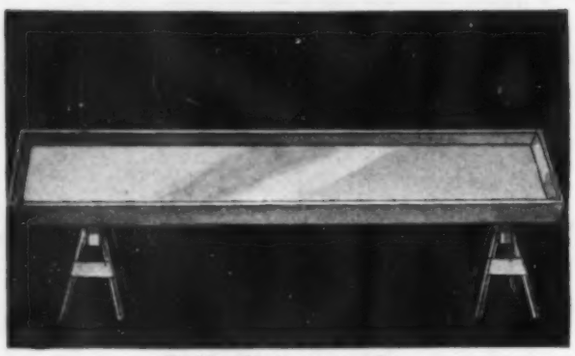
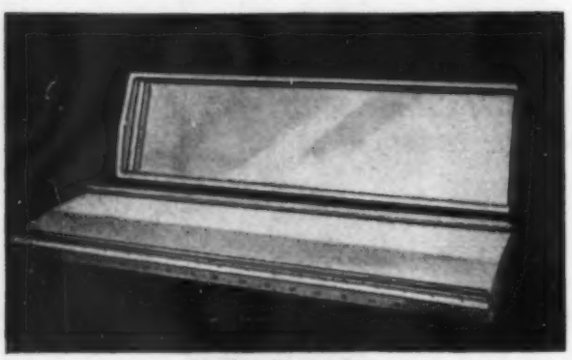
METALS-THE BASIS OF BETTER EQUIPMENT

Highly Resistant to Corrosive Action

Condenser



Rubber Vulcanizing Pan



Rubber Curing Pan

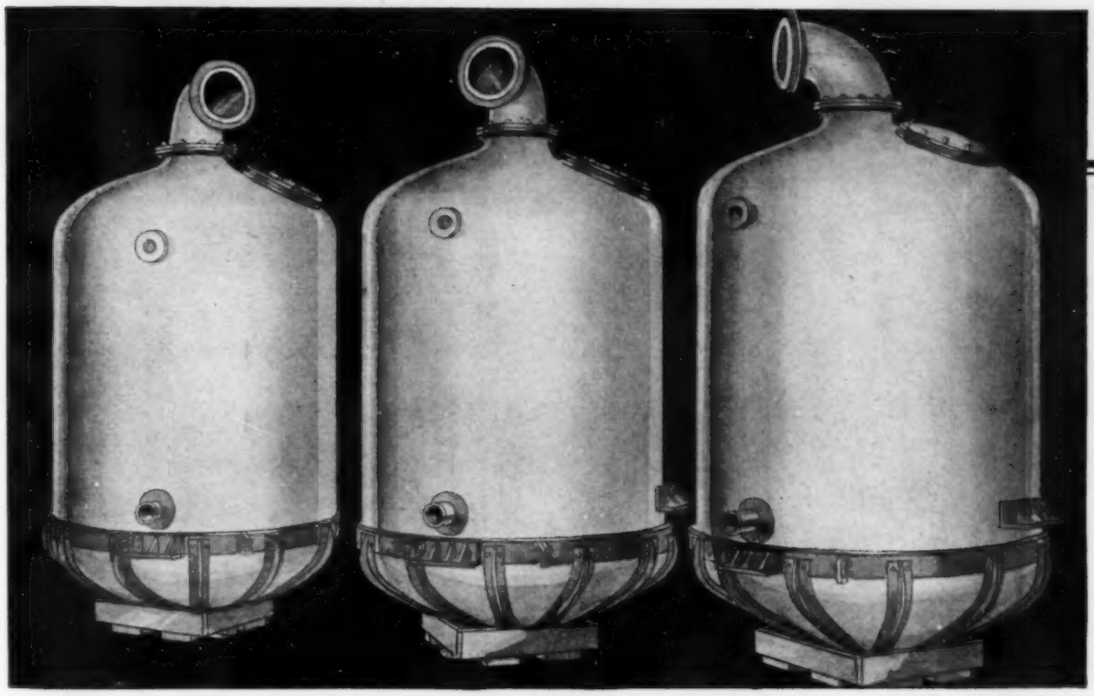
THE selection of equipment material that will withstand the forces of corrosion is a maintenance problem that constantly confronts the chemical industry.

While no one material of construction is completely resistant to all reagents, Aluminum has proven its practical value for many kinds of chemical apparatus, and in direct contact with a wide variety of chemical substances.

Aluminum is used with success in direct contact with such widely used chemical substances as:

Acetic Acid	*Citric Acid*	*Pyroxylin*
Acetanilide	*Fatty Acids*	*Sulphur*
Ammonia	*Formaldehyde*	*Sulphuric Acid*
Amyl Acetate	*Lactic Acid*	*Sulphurous Acid*
Aniline	*Nitric Acid*	*Sulphur dioxide*
Cellulose Acetate	*Nitrous Gases*	*Tannic Acid*
Cellulose Nitrate	*Organic Acids*	*Tartaric Acid*

ALCOA



Retorts

Aluminum is highly resistant to corrosion, even under conditions of constant atmospheric moisture. It also remains stable when subjected to sulfur fumes — a quality of great value to the rubber making industry.

Complete data concerning the use of Aluminum for any equipment you may have in mind will be gladly furnished upon request.

ALUMINUM

for the Chemical Industry

ALUMINUM COMPANY OF AMERICA
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Have Been Added To The Life of Iron

YEARS have now been added to the life of iron by alloying highly refined iron with copper and molybdenum.

These beneficial elements materially increase the rust and corrosion resistance for which iron is noted—and add years to its life.

Toncan Copper Molybdenum Iron easily resists the elements, salt air corrosion, stack fumes, acidulous waters and soil corrosion which quickly destroy other ferrous materials.

As a result, Toncan Iron is being widely adopted for roofing, siding, gutters, downspouts, flashings, piping, and all other building applications.

Let us send you full particulars about Toncan—the iron of permanence.

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World's Largest and Most Highly Specialized Alloy Steel Producers
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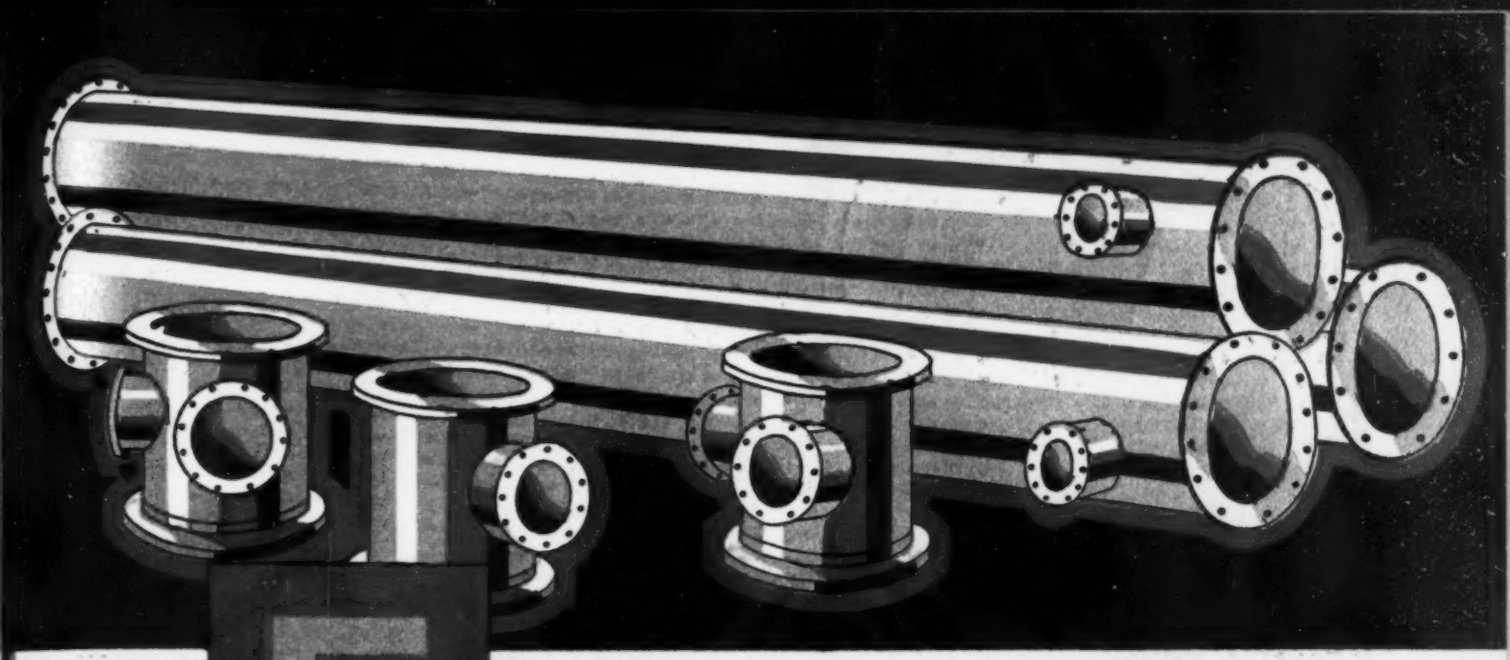
Export Office: New York Central Building, New York, N. Y.

TONCAN COPPER MO-LYB-DEN-UM IRON



ENDURO

ENDURO KA2

provides the *corrosion control* essential for process industries

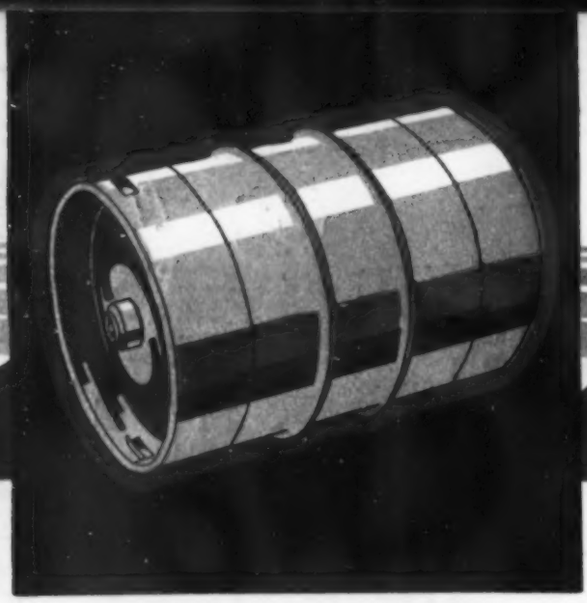
MANUFACTURERS and designers of equipment used in the process industries have turned to Enduro Nirosta KA2 for the solution of their corrosion problems. ▲▲ This new chrome-nickel-iron alloy resists a wider range of corrosive media than any other comparable material. Even at great temperatures and pressures it easily withstands the attack of many acids and chemicals that quickly destroy other metals. ▲▲ In addition, Enduro also provides all mechanical qualifications essential for fabrication. It has working qualities similar to those of ordinary steel. And tough, ductile welds are obtained due to the fact that Enduro has no capacity for hardening except by cold working. ▲▲ In all process industries, wherever corrosive products are manufactured or must be handled, Enduro KA2 provides the CORROSION CONTROL and all other requirements essential for economical operation. ▲▲ The companies listed below are licensed to produce Enduro KA2 in America. Metallurgists of these companies will be glad to discuss your corrosion problems with you, and furnish complete information relative to the advantages of Enduro KA2.

NIROSTA KA2 STEEL

CENTRAL ALLOY STEEL CORP.
Massillon and Canton, Ohio

LUDLUM STEEL COMPANY
Watervliet, N. Y.

THE BABCOCK & WILCOX TUBE CO.
85 Liberty Street, New York, N. Y.



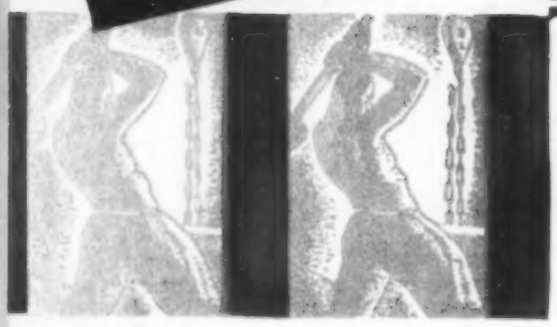
ENDURO has met a definite need in industry. Already scores of manufacturers are using or experimenting with this new steel that neither stains, nor tarnishes, nor rusts. ¶ Enduro is an alloy of chromium, nickel and iron. It is proof against water, atmospheric attack, dilute solutions and even acids at high temperatures and under great pressures. ¶ Its lustre is permanent! An occasional wiping with a damp cloth is sufficient to preserve its spotless cleanliness indefinitely. Enduro is the same durable metal throughout—never wears thin or grows spotty. ¶ Enduro is stronger than most steels. It can be deep drawn, wire drawn, spun, machined and welded. Available in the conventional shapes and sizes. And in spite of its unusual qualities, Enduro is practical from the standpoint of costs.

A striking booklet describes this new steel. Write for it today. Address any of the three companies listed below. No obligation is involved.

CENTRAL ALLOY STEEL CORP. Massillon and Canton, Ohio

LUDLUM STEEL CO. Watervliet, N.Y.

THE BABCOCK & WILCOX TUBE CO. 85 Liberty St., New York City, N.Y.



ENDURO NIROSTA KA2 STEEL

SEAMLESS ENDURO KA2

—*Easily Fabricated*

Seamless Pipe of Enduro KA2 expanded at both ends and flattened (cold worked).

Seamless Enduro KA2 belled in the cold state.

Seamless Enduro KA2 flattened cold without any fracture.

THE working properties of Seamless Pipe of Enduro KA2 are similar to those of ordinary steel. It can be easily bent, threaded, flanged or otherwise formed, thus facilitating the work of installation.

This ease of working is in marked contrast to the fragility of special non-corrosive materials heretofore used, such as glass, stoneware, and high silicon cast iron.

Because of this outstanding advantage, Seamless Enduro KA2 is finding extensive use in many industries where agents corrosive to ordinary ferrous materials must be handled.

Seamless Pipe of Enduro KA2 is furnished with plain ends, threaded and coupled, or with flanges of Enduro KA2. Cast fittings of Enduro KA2 can also be supplied.

The Seamless Enduro KA2 booklet gives the chemical, physical and other properties of this new chrome-nickel alloy. Send for a copy.

Enduro KA2, manufactured by Central Alloy Steel Corporation, is fabricated into seamless tubes and pipe by

THE BABCOCK & WILCOX TUBE CO.

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Beaver Falls, Pa.

Seamless
ENDURO
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Tubes and Piping

General Sales Office:
85 Liberty Street
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METALS-THE BASIS OF BETTER EQUIPMENT

ALLEGHENY METAL & ASCOLOY 33

CORROSION controlling alloys . . . . . metals fearing neither the sting of caustics nor the bite of acids.

Tough, strong metals that can stand on their own feet in the construction of heavy equipment, yet cost little, if any more than less able materials.

ALLEGHENY METAL AND ASCOLOY 33 . . . . . both possessing these general characteristics, yet each best suited to solution of specific problems in atmospheric and chemical corrosion. Available in commercial shapes, sizes and forms.

Technical bulletins on request.

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New York Buffalo Cleveland Chicago Detroit
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Sheets for Automobile Bodies · Metallic Furniture · Deep Draws Allegheny Metal · Ascoloy · Electrical Sheets · Steel Castings · Boiler Tubes · Pipe

METALS-THE BASIS OF BETTER EQUIPMENT

for products requiring

Non-Corrosive Storage*

WATERBURY CHEMICAL CO.
INCORPORATED
PHARMACEUTICAL CHEMISTS

DES MOINES OFFICE & LABORATORY
NEW YORK OFFICE & LABORATORY
NEW ORLEANS OFFICE & LABORATORY
TORONTO OFFICE & LABORATORY

FOREIGN OFFICES
HONG KONG CALCUTTA
SHANGHAI COLOMBO
MANILA SINGAPORE
SYDNEY MADRAS
BOMBAY KARACHI

CABLE ADDRESS

New Orleans, La;

April
Twenty
Ninth,
1 9 2 9.

International Nickel Company
67 Wall Street,
New York City, New York.

Attention: Mr. E. A. Turner:

Dear Sir:

Answering your inquiry as to why we installed Monel Metal lined Tanks for storage of our preparation, WATERBURY'S COMPOUND.

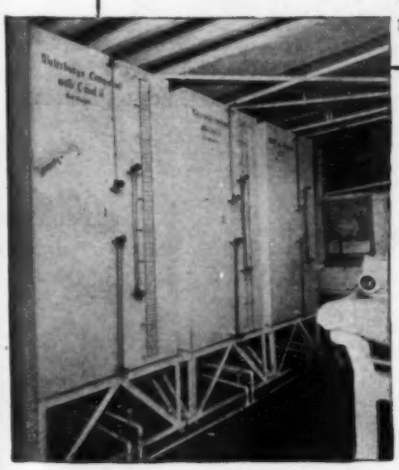
WATERBURY'S COMPOUND is a concentrated vitamin product obtained from predigested Cod Liver Oil by the action of animal glands, and its consistency and physical nature is such that if it is not stored in either glass or non-corrosive material its stability is greatly impaired. After making exhaustive tests with Monel Metal strips and co-operating with your Mr. Edward Schwartz of New Orleans, we found that Monel Metal was the ideal material in which to store WATERBURY'S COMPOUND, it being less perishable than glass and more easily cleaned. We, therefore, installed three 1000-gallon tanks which have been in constant service for the past six months with perfect satisfaction.

* For concerns manufacturing a product that requires non-corrosive storage we would not hesitate to recommend Monel Metal.

Yours very truly,

WATERBURY CHEMICAL COMPANY.

BY C. C. Waterbury
MGR., N. O. BRANCH.



Three 1,000 gallon Monel Metal lined tanks in the New Orleans plant of the Waterbury Chemical Co. Manufactured by J. P. REID, 107 South Robertson Street, New Orleans, La.

TANKS of Monel Metal

PHARMACEUTICAL manufacturers are turning to Monel Metal tanks as the solution of their storage problems.

Monel Metal tanks protect the product from contamination. They resist the corrosive attacks of most acids, alkalis and essential oils. They cannot rust and their durability is greater than that of any other available material.

If you have a chemical storage problem, we suggest that you investigate the economy of Monel Metal tanks. Information about Monel Metal in relation to your particular requirements will be gladly sent on request.

Monel Metal is a technically controlled Nickel-Copper alloy of high Nickel content. It is mined, smelted, refined, rolled and marketed solely by The International Nickel Company, Inc. The name "Monel Metal" is a registered trade mark.

MONEL METAL

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

INCO MONEL METAL

Just Out!

For the engineer, designer and steel worker—Tested information on the safe stress of various steels for temperatures ranging over 1,000 degrees F.

Creep of Steel at High Temperatures

By F. H. NORTON

Babcock & Wilson, Research Fellow, Massachusetts Institute of Technology

90 pages, 6x9 inches, illustrated
$3.00 postpaid

This concise volume is the result of a most ambitious research carried on under exacting conditions and for the first time places available a practical source of information for the engineer and designer. A field which heretofore has been covered only with indefinite theories and ever-changing conclusions has been clarified with accurate findings of a usable nature. Photographs, microscopic studies and tabulated instrument readings have recorded the research work and make the material immediately available for practical construction purposes.

Chapter Headings

1. Introduction
2. The Physical Condition of Steel at High Temperature
3. Creep Test Methods
4. The Babcock & Wilson Creep Apparatus
5. Description of the Steels Tested
6. Results
7. Precision of these Values
8. Discussion of the Results
9. Creep Results of Other Experimenters
10. Application of Creep Values to Design
11. Conclusions

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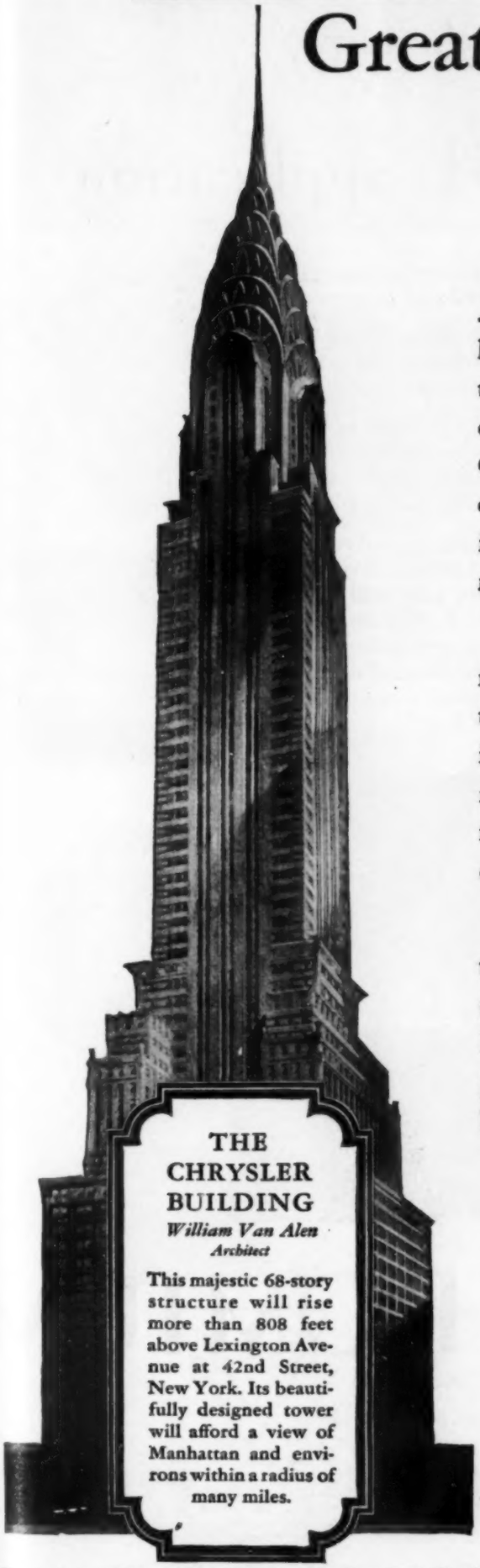
Care of THE PUSEY AND JONES CORPORATION, Front and Poplar Sts.
WILMINGTON, DELAWARE

METALS-THE BASIS OF BETTER EQUIPMENT

Greater Permanency With Alloy Steel



THE CHRYSLER BUILDING
William Van Alen
Architect

This majestic 68-story structure will rise more than 808 feet above Lexington Avenue at 42nd Street, New York. Its beautifully designed tower will afford a view of Manhattan and environs within a radius of many miles.

A NEW alloy steel containing chromium has been found admirably suited for both exterior and interior metal decoration. Selection of this steel for the lofty tower of the new Chrysler Building and for the major portion of the exterior metal decoration emphasizes its adequacy in meeting the demand for permanency.

This steel shows complete resistance to atmospheric corrosion. It possesses the exceptional quality of retaining its color and luster; its surface does not tarnish; and, the metal being rustless throughout, there is no danger of surface deterioration, peeling, chipping or other change. It eliminates maintenance expense.

Increasing demand for permanent architectural beauty urges building designers to make a thorough investigation of alloy steel. Our Metallurgical Engineers shall be pleased to explain how the properties outlined above may be obtained from the use of ferro-alloys.

ELECTRO METALLURGICAL SALES CORP.
Unit of Union Carbide UCC *and Carbon Corporation*
Carbide and Carbon Building, 30 East 42nd Street
New York, N. Y.

Electromet
Ferro-Alloys & Metals

METALS-THE BASIS OF BETTER EQUIPMENT

Another interesting

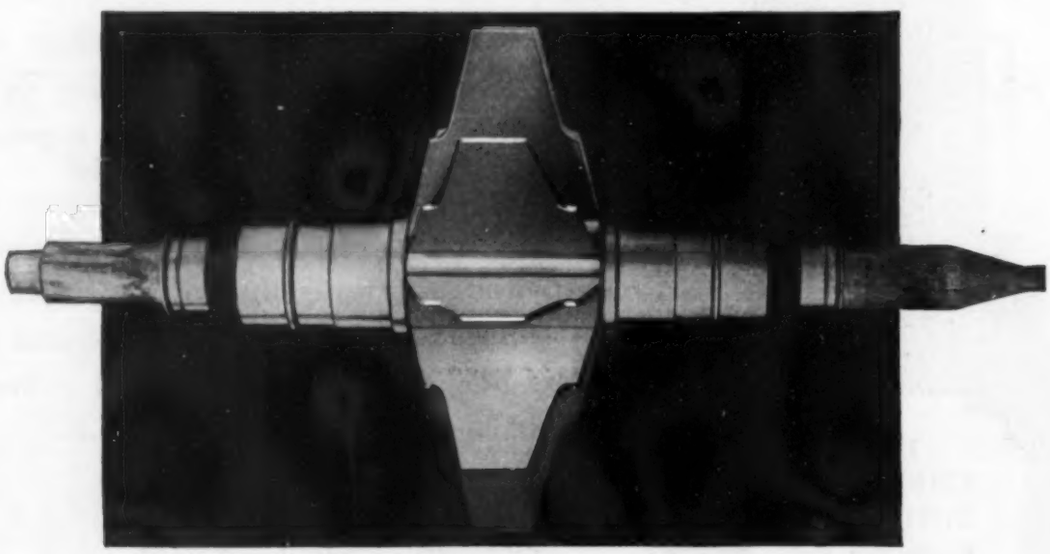
CHROMIUM application

THIS is a high-speed balanced rotary gas impeller. It is U.C. Chromium Plated on forged and heat-treated steel.

It has been definitely proved that Chromium Plate will materially lengthen the life of such equipment over the life of unplated parts. Many interesting reports available!

Minute particles of solid matter in the gases . . . which would ordinarily ruin blades of forged steel in a few months . . . apparently do not affect the U. C. Chromium Plated surface. Have you such a problem?

United Chromium, Inc. is helping to solve problems of wear and corrosion in widely diversified industries. Our bulletin No. 1.B. will give you a general outline of U.C. Chromium Plate and our engineering and research facilities. Or we should be pleased to answer specific questions contained in your first letter.



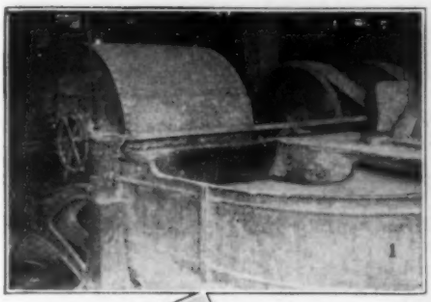
UNITED CHROMIUM

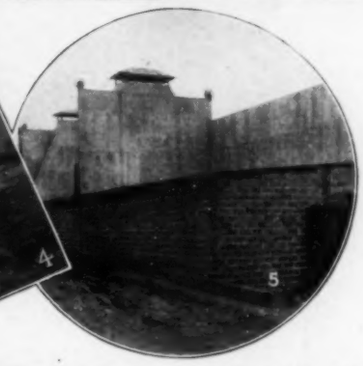
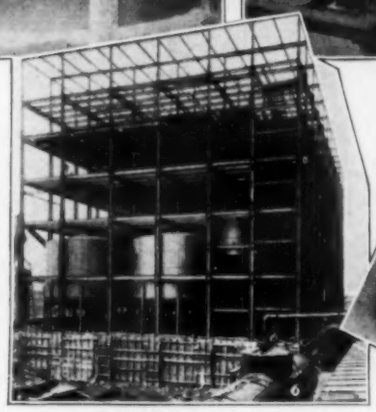
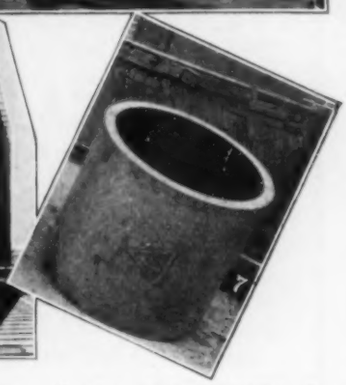
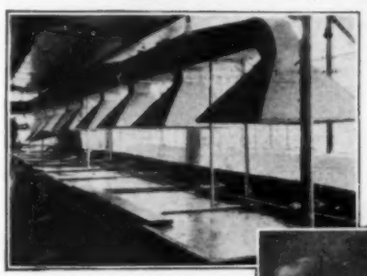
INCORPORATED

Executive Office: 51 East 42nd Street, New York City

Chicago, Ill. • *Cleveland, O.* — *Detroit, Mich.* • *San Francisco, Calif.* • *Waterbury, Conn.*

METALS-THE BASIS OF BETTER EQUIPMENT



1. Beater Hood, Gardner-Harvey Paper Company, Middletown, Ohio.
2. Tank for storing carbonic acid liquid gas, The Atlantic Carbonic Company, Chelsea, Massachusetts.
3. Column pedestals, United States Nitrate Plant, Muscle Shoals, Alabama.
4. Soap kettle, Waltke Soap Company, St. Louis, Missouri.
5. Siding on drying kiln, Standard Sanitary Works, New Brighton, Pennsylvania.
6. Fermenter tanks, Pennsylvania Sugar Company, Camden, New Jersey.
7. Glue Cooker, Charles B. Francis Company, Rushville, Indiana.
8. Ventilators over rosin size cooking vats, Champion Coated Paper Company, Hamilton, Ohio.
9. Dust Collecting System, Lewiston Bleachery & Dye Works, Lewiston, Maine.
10. Driers, Consolidated Paper Company, Monroe, Michigan.
11. Roofing and siding on distillery plant of Ross Company, Lawrenceburg, Indiana.

Corrosion hazards that were diminished

THE chemical process industries demand much from sheet and plate equipment. Corrosion takes terrific toll here, unless the metal, like ARMCO Ingot Iron, is fortified to resist the ruthless attack.

For twenty-two years the staunch corrosion resistance of pure iron has brought substantial savings to many manufacturers in the process industries. Some of these plants and equipment are shown here.

Possibly, your "corrosion hazard" can be lessened, too. Perhaps you would like to have our experienced ARMCO Development Engineer investigate. The office organization nearest you will gladly assist. Call on them.

THE AMERICAN ROLLING MILL COMPANY

Executive Offices: **Middletown, Ohio**

Export: **The ARMCO International Corporation**

***Cable Address*—ARMCO, Middletown, (O)**

DISTRICT OFFICES: Chicago, Cincinnati, Cleveland, Detroit, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco

ARMCO INGOT IRON RESISTS RUST

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Stainless Fittings In Stock

Machined Fittings in stock for immediate shipment.

Also DURALOY Gate, Globe, Angle, "Y," Butterfly Valves available.

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For use in Sulphite Paper Mills

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Acid Mine Waters
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The Duraloy Company

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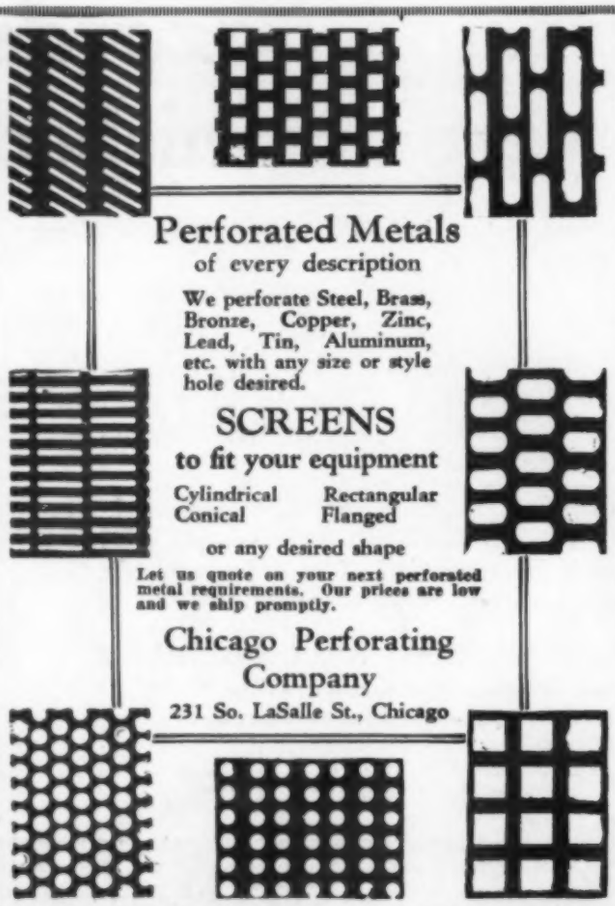
Boston, Chicago, Cleveland, New York, El Paso, St. Louis
Plant: New Cumberland, W. Va.

STEEL PLATE WORK for Chemical Processes.

TANKS for all Purposes
Digesters, Evaporators, Retorts, Stills, Rotary Kilns, Dryers, Filters, Stacks, Bins, Hoppers
REFINERY EQUIPMENT

LANCASTER IRON WORKS

INCORPORATED
LANCASTER, PA.



Perforated Metals

of every description

We perforate Steel, Brass, Bronze, Copper, Zinc, Lead, Tin, Aluminum, etc. with any size or style hole desired.

SCREENS

to fit your equipment

Cylindrical Rectangular
Conical Flanged

or any desired shape

Let us quote on your next perforated metal requirements. Our prices are low and we ship promptly.

Chicago Perforating Company

231 So. LaSalle St., Chicago

THERMIT

Carbide Free Metals and Alloys

Ferro Titanium.....25% Ti.
Ferro Chromium.....60% Cr.
Ferro Tungsten.....75-80% W.
Ferro Vanadium.....35-40% V.
Pure Manganese....96-98% Mn.
Pure Chromium.....97-98% Cr.

Send for Pamphlet No. 2041

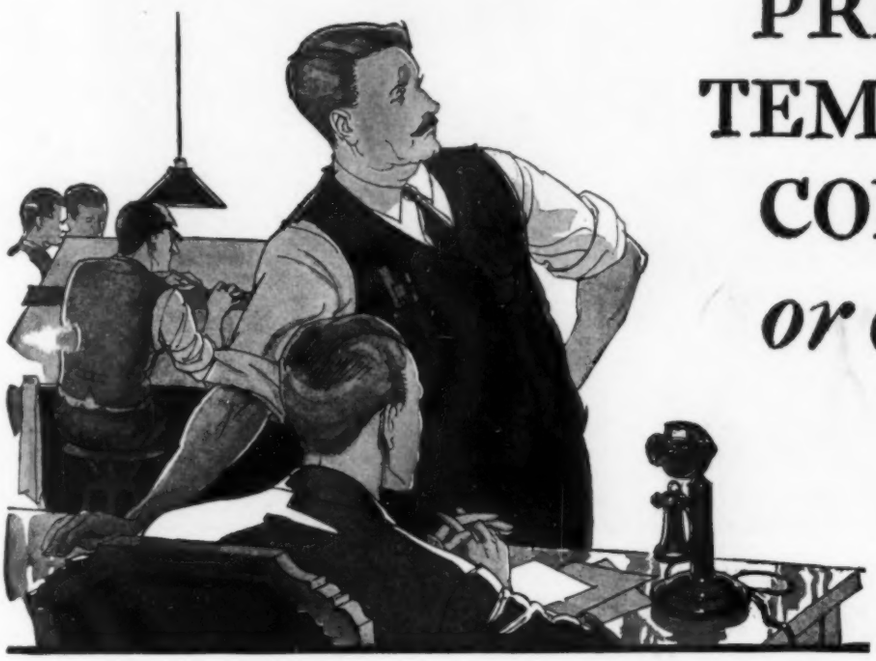
METAL & THERMIT CORPORATION
120 BROADWAY, NEW YORK CITY

Pittsburgh Chicago Toronto Boston S. San Francisco

METALS-THE BASIS OF BETTER EQUIPMENT

If your problem involves

PRESSURE
TEMPERATURE
CORROSION
or all three..



We give below a partial list of corrosive agents to which* STAINLESS *Steels are either wholly or practically immune

Fruit Acids
Fruits
Glue
Hydrocyanic Acid
Hydrogen Peroxide
Hydrogen Sulphide (wet or dry)
Ink
Iodine
Lactic Acid
Lead Acetate (sugar of lead)
Lead Carbonate (basic)
Lead (molten)
Lemon Juice
Lime (calcium hydroxide or oxide)
Lysol
Magnesium Carbonate
Magnesium Chloride
Magnesium Sulphate
Manganese Sulphite
Meats
Menthol (dilute)
Mercuric Chloride (dilute)
Mercuric Nitrate
Mercurous Nitrate
Mercury
Milk
Molybdic Acid
Nickel Sulphate
Nitric Acid
Novocaine
Oils (petroleum or vegetable)
Oleic Acid
Phenol
Phosphoric Acid
Picric Acid
Potassium Carbonate
Potassium Chloride
Potassium Cyanide
Potassium Hydroxide
Potassium Oxalate
Pyrogallic Acid
Rubber
Salt Water
Silver Bromide
Silver Nitrate
Soap
Sodium Acetate
Sodium Bicarbonate
Sodium Carbonate
Sodium Cyanide
Sodium Dichromate
Sodium Hydroxide
Sodium Hypochlorite
Sodium Nitrate
Sodium Nitrite
Sodium Oxalate
Sodium Salicylate
Sodium Sulphate (dilute)
Sodium Sulphite (mono)
Sodium Thiosulphate
Soft Soap
Sour Milk
Steam (superheated or wet)
Stearic Acid
Sugar
Sulphur Dioxide (wet or dry)
Tannic Acid
Tannin
Tartaric Acid
Thymol
Tin (molten)
Tungstic Acid
Type Metal (molten)
Vegetables
Vinegar
Water
Zinc Chloride

THE most remarkable characteristic of Stainless Steel is its resistance to corrosion, erosion, oxidation, distortion and fracture under high temperature and pressure. This advantage makes "Stainless" Process Equipment particularly desirable and highly economical.

Stainless Steel is *not* limited in physical properties. Its "range" is much wider than that of ordinary steel....*Brinell* 150 to 600 and *tensile strength* 60,000 to 250,000 pounds per square inch.

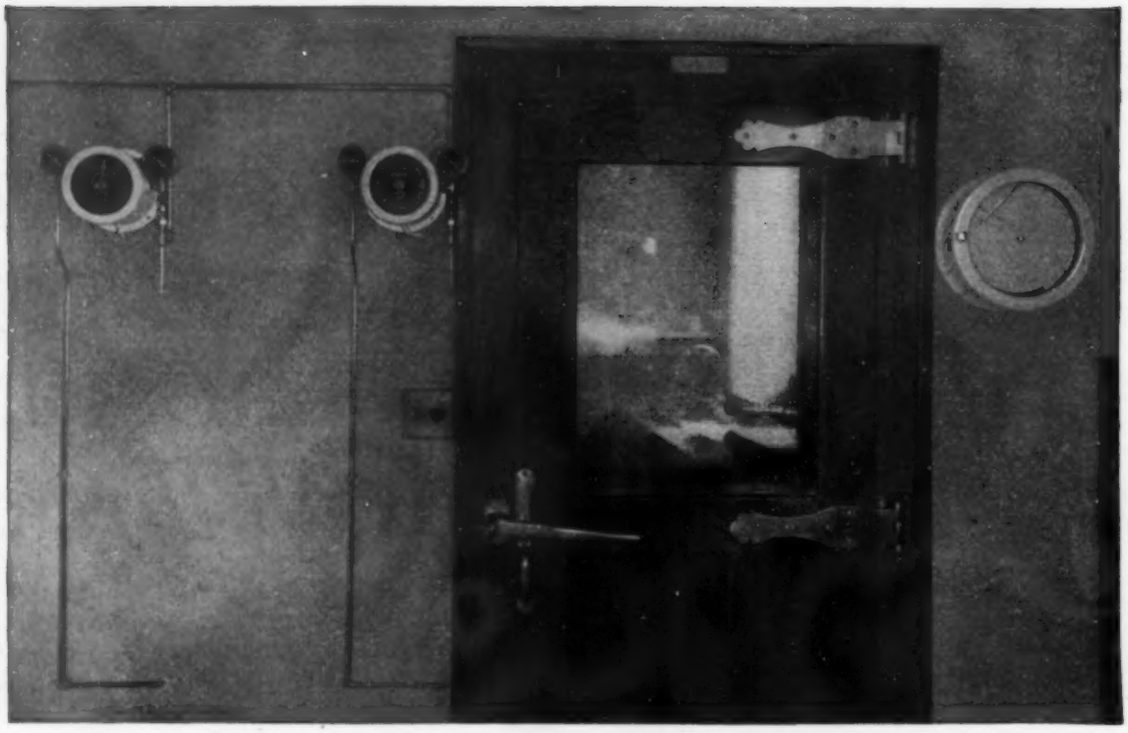
"Stainless" can be rolled, drawn, stamped, forged, pressed, machined, cast, spun, punched, brazed, soldered, welded, ground and polished. "Stainless" is "the metal of endless possibilities." It will help solve your own problems ... Write us for further data.

***Genuine* Stainless Steel is manufactured only under the *patents* of**

AMERICAN STAINLESS STEEL COMPANY
Commonwealth Building
Pittsburgh, Penna.

STAINLESS

STAINLESS STEEL



Bugs Prefer Perfect Temperature

THIS is an incubation room in the Beth Israel Hospital in New York. Here cultures are developed under ideal conditions. The temperature of the room must be exactly 37.5° C continually. Even a variation of 1° will raise havoc with the bacteria. Bugs demand perfect temperature conditions.

The bacteriologist is a scientist—his conclusions are based upon facts. Guesswork plays no part in his work. Industry is approaching the same ideal. Many process industries can be truly scientific—if critical temperatures are controlled and the facts recorded.

The instruments used are American Air-Operated Temperature Controllers and American Mercury Actuated Recording Thermometers. That these instruments have given the most satisfactory performance under such exacting conditions is proof positive of their practicability for any service.

Specify Catalogs Desired

American Dial Thermometers	G-4
Consolidated Safety Valves	Z-4
Hancock Globe & Check Valves	X-4
American Recording Thermometers	H-4
American Temperature Controllers	R-4
Ashcroft Power Control Valve	M-4
Metropolitan Injectors	Y-4
American Relief Valves	V-4
American Glass Thermometers	F-4
Ashcroft Gauges	T-4
American Quality Gauges	A-4
American Recording Gauges	E-4
American Draft Gauges	B-4
American Gauge Testers	D-4
American Tachometers	J-4

CONSOLIDATED ASHCROFT HANCOCK COMPANY, INC.
Bridgeport, Conn.

Subsidiary of Manning, Maxwell & Moore, Inc.

AMERICAN INSTRUMENTS
SINCE 1851

MEET THE MOREHEAD ENGINEER

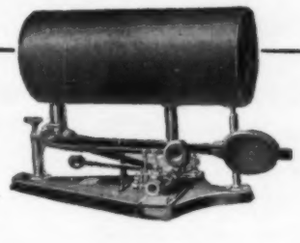
He Will Help You Bring About the PROMPT REMOVAL *and* PROFITABLE DISPOSAL *of* ALL *Condensation*

For 36 years the Morehead Engineer has devoted himself exclusively to IMPROVING steam drainage and boiler feeding, in thousands of plants all over the country. In all of these plants . . . many of them similar to your own . . . he has installed the Morehead Back-to-Boiler System, which performs these fundamental and vitally important services:

1. Drains all kinds of steam-heated apparatus . . . *immediately* and *thoroughly.*
2. **Enables steam-heated apparatus to work at full capacity, thus *increasing production* and *improving quality* of product.**
3. Handles water of condensation at any temperature—212° and above—the higher the better.
4. Automatically *returns* all condensation to boilers at *original high temperature* . . . thus saving valuable heat units in excess of 212° F.
5. Supplies the boiler with pure, hot, distilled feed water which deposits no scale and, in addition, acts as a most efficient boiler compound in purging the boiler of accumulated scale and dirt.
6. Uses only *ten per cent* of the steam that is required by a pump doing the same work.
7. Eliminates need for a lifting pump, taking the place of such a pump and operating as simply as the law of gravity.
8. Definitely insures *fuel savings* and *lower operating costs.*

MOREHEAD MANUFACTURING CO.
Department CM DETROIT, MICHIGAN

Morehead
Back to Boiler
SYSTEM



MOREHEAD MANUFACTURING CO., Department CM Detroit, Michigan (417)

I'd like to have your interesting 44-page booklet, giving helpful information regarding the Morehead Back-to-Boiler System. This will, of course, place me under no obligation.

Name_____

Company_____ Address_____

City_____ State_____

HEAT WITH UNIT HEATERS

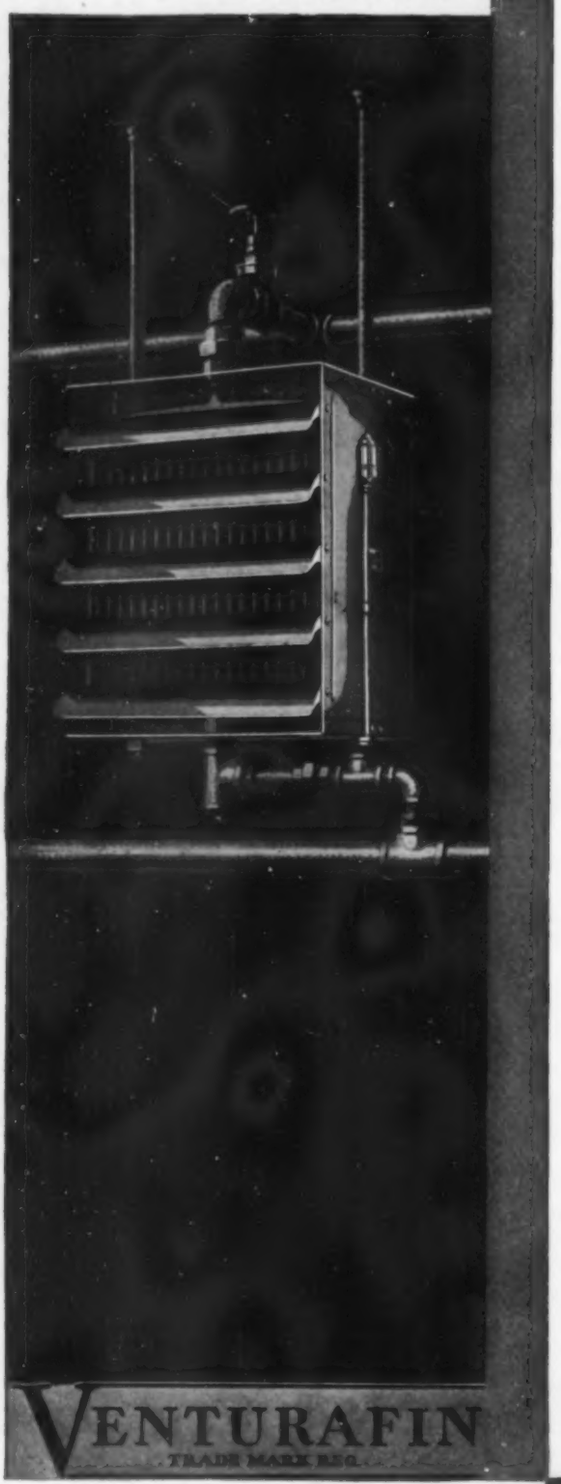


Illustration shows the simple and sturdy method of supporting a Venturafin Unit Heater from the ceiling, with ordinary ¾-inch hanger pipes. Venturafin Units can also be supported on a wall or column, or can be used as a floor stand unit with a recirculating box.

"Heat Control" ..an invaluable feature of Venturafin Unit Heaters

A vital factor in heating stores, offices, garages, factories and many other buildings

1—No building is too large or too small to receive the benefits and economies of the Venturafin Method of Heating.

2—Forced heat, at any desired velocity, directed in one or several directions simultaneously, is made possible by Venturafin's three-speed heat control switch and individually adjustable streamline heat deflectors.

3—"Low" on the heat control switch, and Venturafin forces a gentle stream of heated air directly into working areas.

4—"Medium" on the heat control switch, and Venturafin forces heated air at a higher velocity in the desired directions.

5—"High", and Venturafin is transformed into a high velocity unit that forces great quantities of heated air into circulation. Comfortable working conditions are assured, even under the most severe outside weather conditions and on unusually short notice.

6—No longer is there any danger of a plant being too cold or too hot in which to work. No longer are ceiling areas heated before working areas. There is no guesswork or chance—Venturafin gives positive heat control.

Venturafin Unit Heaters are built in many styles and types for a varied line of installations. They are sold by heating contractors in every locality. Send for our "Red Data" File, containing complete information on Venturafin Unit Heaters, capacities, specifications and prices. There is no obligation. Mail the coupon today.

(942)

AMERICAN BLOWER CORP., DETROIT, MICH.
CANADIAN SIROCCO CO., LIMITED, WINDSOR, ONT.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

American Blower

VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAF

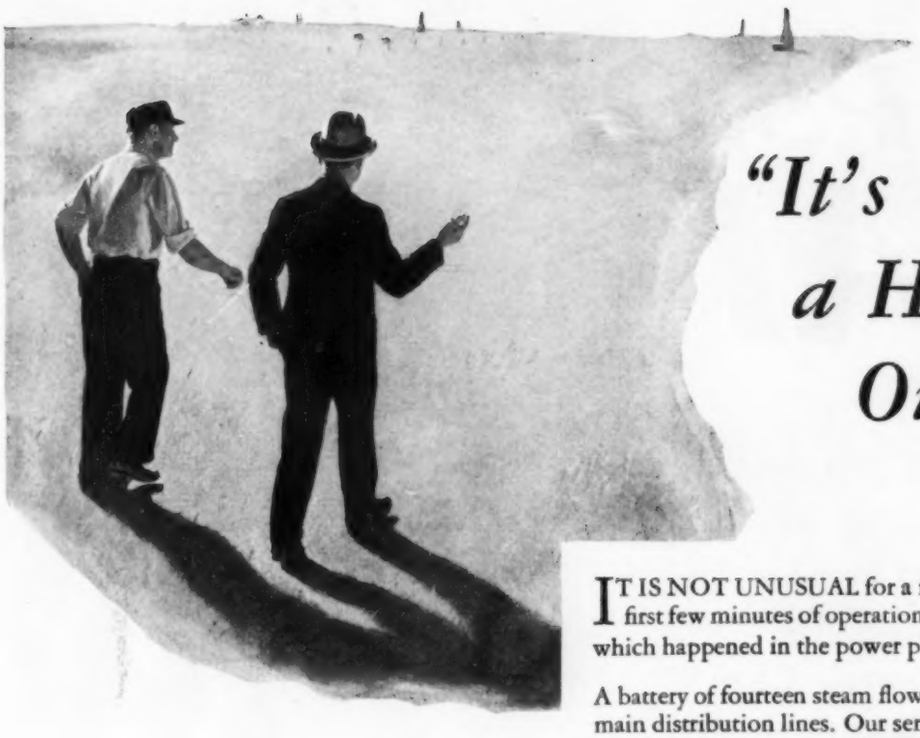
C O U P O N

AMERICAN BLOWER CORPORATION
6000 Russell Street, Detroit, Michigan

Gentlemen: Please send me your "Red Data" File.

*Name*_____ *Firm Name*_____

*Street Address*_____ *City*_____ *State*_____



"It's a Half Mile Out There!"

IT IS NOT UNUSUAL for a flow meter to pay for itself during the first few minutes of operation. Take, for example, this little incident which happened in the power plant of a well-known salt works.

A battery of fourteen steam flow meters had just been installed in the main distribution lines. Our service man was making his final check-up when the power superintendent happened to come along.

The superintendent stopped — looked at the meters and pointed to one, remarking, "You haven't set this meter yet, have you?"

"Yes, it is operating," replied our service man.

"I don't think it can be right — it's showing a flow of about 600 pounds per hour to a well that has been shut down for nearly two months."

"That is what your engineer told me, but I feel sure the meter is correct. How far is it out to that well?"

"It's a good half mile, but if you think the meter is correct, I'll hike out there with you and you can see for yourself."

In about an hour they returned. "That flow meter has paid for the entire installation already," remarked the superintendent. "How long that trap has been leaking or how long it would have continued to leak is hard to say, for we seldom have occasion to go out to a well that is shut down."

Republic Flow Meters can perform a similar service in your plant.

You weigh your coal; are you measuring your steam? It is better economy to buy pounds of steam than pounds of coal

Bulletin "Steam Economy" mailed on request

REPUBLIC FLOW METERS COMPANY

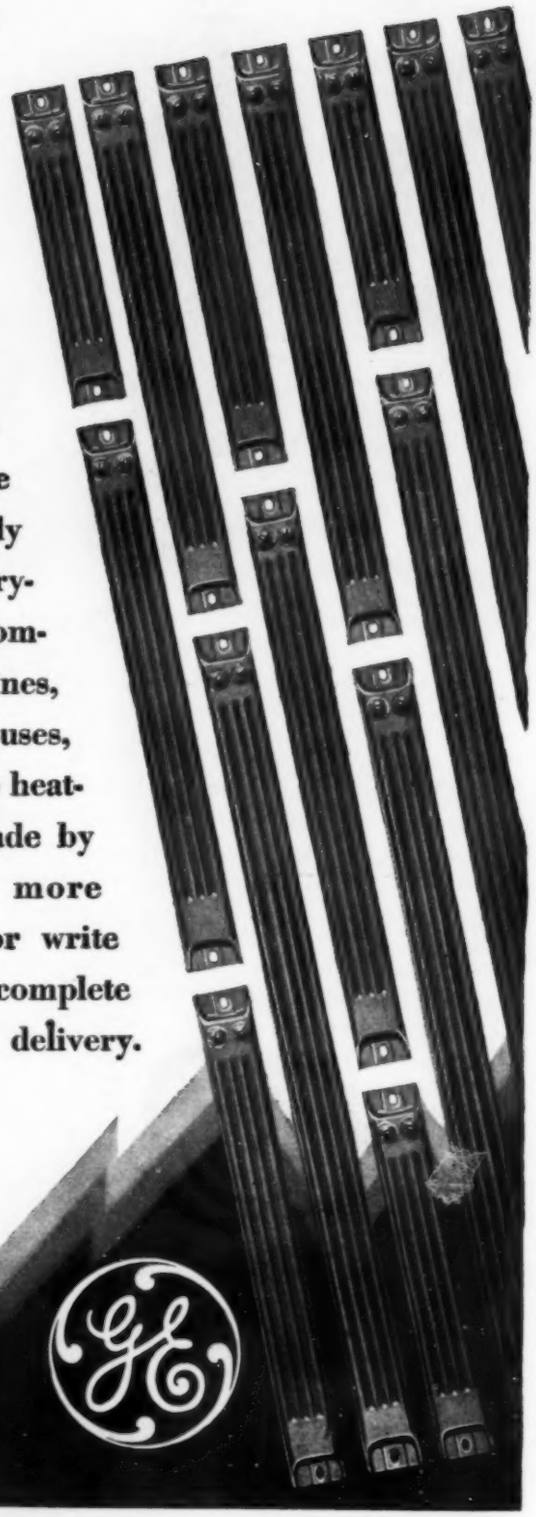
Executive Offices and Plant · 2233 Diversey Parkway · Chicago, Ill.

Branch Offices in 25 Principal Cities

DOMINION FLOW METERS CO., *Toronto, Canada* ELEKTROFLO, *Berlin, Germany* ELECTROFLO METERS CO., *London, England*

REPUBLIC FLOW METERS

STRIPS OF HEAT



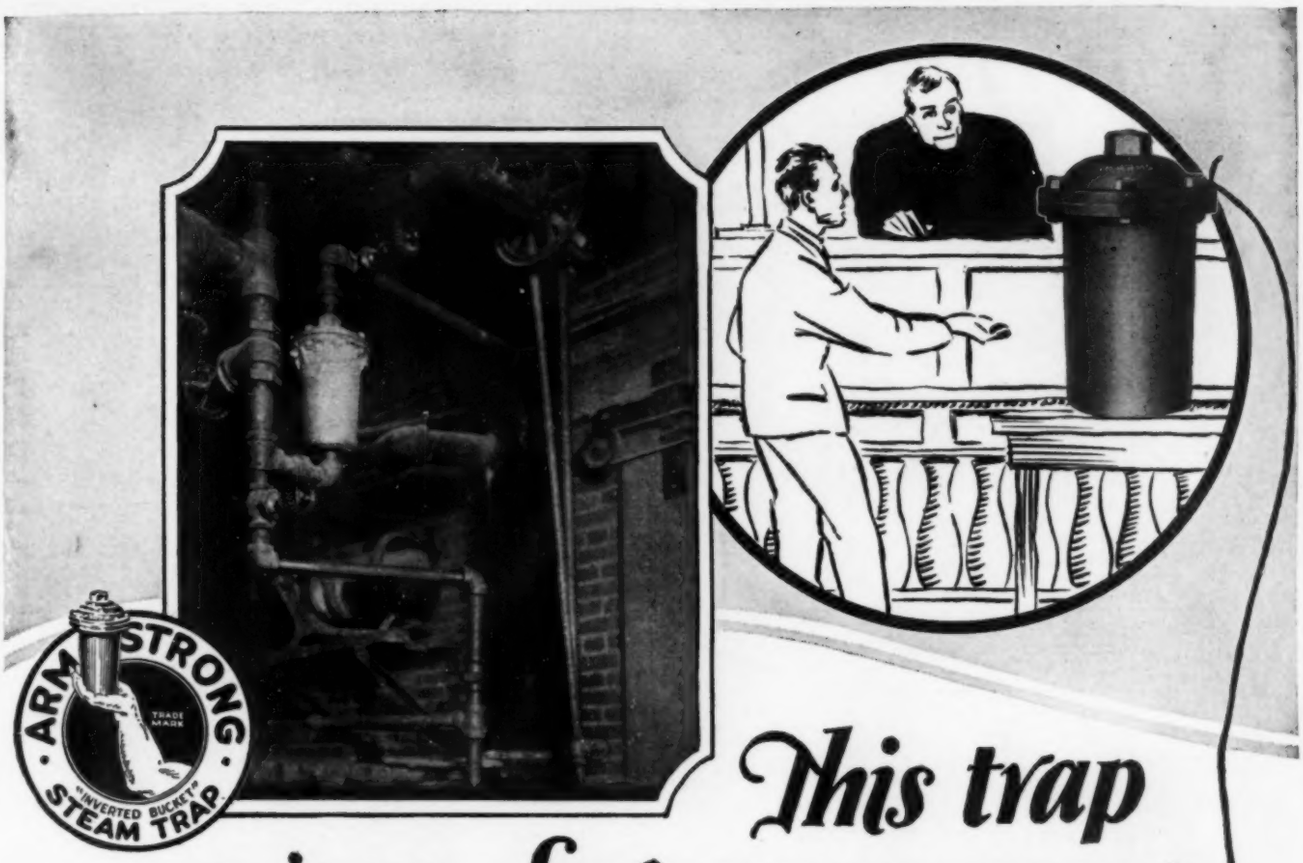
Strips of Heat (G-E electric strip heaters) provide clean, safe, economical, and convenient heat—permitting uniform distribution of heat and accurate automatic control. ¶Use these handy units on your process machines, drying equipment, warming tables, compound tanks, glue tables, oil lines, water baths, valve and pump houses, etc. ¶You won't find better strip heaters, anywhere, than these, made by General Electric—nor any more reasonably priced. Call up or write your nearest G-E office for complete information, prices, and delivery.

570-98

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 9 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES



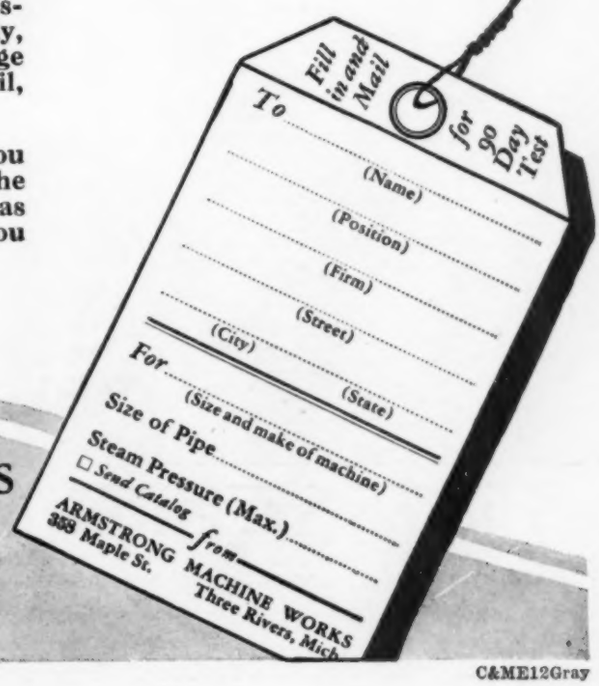
This trap can't sue for non-support—

FAILURE to provide (a support) is no valid argument in the case of the Armstrong Steam Trap. It's light and compact enough to work efficiently without special support, as the picture taken in the above plant shows.

Its claims for long trouble-free service, however, get plenty of support. Thousands of installations have proved the ability of the Armstrong Trap to discharge condensate positively and automatically, without air binding. It's self-scrubbing also—sludge is discharged with the condensate, as well as oil, scum, gases and entrained air.

To prove these strong statements we can make you a "companionate" proposition. Your name on the tag below brings you as many Armstrong Traps as you require, for 90 days' trial—without cost to you or obligation.

Made in sizes and types for pressures to 900 lbs. and temperatures to 750° F.



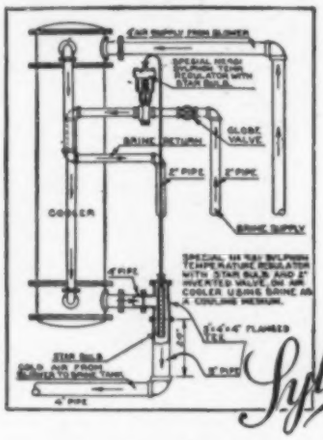
ARMSTRONG MACHINE WORKS

358 Maple Street :: Three Rivers, Michigan

District Representatives in 42 Cities

C&ME12Gray

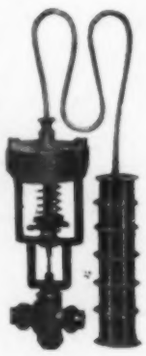
Year in and Year out



Accurate Temperature Regulation of Air, Liquids or Gases

Air, cooled to a definite temperature, can be delivered from an air cooler controlled by proper temperature regulation. Such cooled air may be used for a variety of purposes, particularly in cooling small masses and small spaces in extruding machines, pill making machines, etc. The stream of cold air, directed to come in contact with the manufactured product, will prevent spoilage arising from stickiness, etc., caused by heat generated in the operations. There are many such processes carried out in the manufacture of confectionery, pharmaceutical products, cosmetics, etc., where the heat generated has a deleterious effect on the product. The stream of controlled, cooled air prevents this heat from exerting harmful action.

It makes little difference what are the conditions under which it must work or what the velocity of the pressure to be used, or what substance is to be controlled, be it—air, steam, vacuum or liquids, there is a Sylphon Temperature Regulator that can easily be installed and which will do your job absolutely, 24 hours a day—year in and year out. Write for Bulletin B-175.



No. 981 Spring Type for controlling temperature of air. Has double-seated balanced valve suitable for high or low pressures. Made in valve sizes ½ in. to 2½ in. inclusive.

FULTON SYLPHON CO.
KNOXVILLE, TENN., U.S.A.

Representatives in all Principal Cities in U. S. A.—European Representatives, Crosby Valve & Eng. Company, Ltd., 41-2 Foley St., London, W. 1., England—Canadian Representatives, Darling Bros., Ltd., 140 Prince St., Montreal, Que., Canada.

ROCKWELL
Air-Tight Blast Gates
for every purpose

Threaded Connections

Threaded Connections
Rack and Pinion
Operating Mechanism

Flanged Connections
Hand Lever
Operating Mechanism

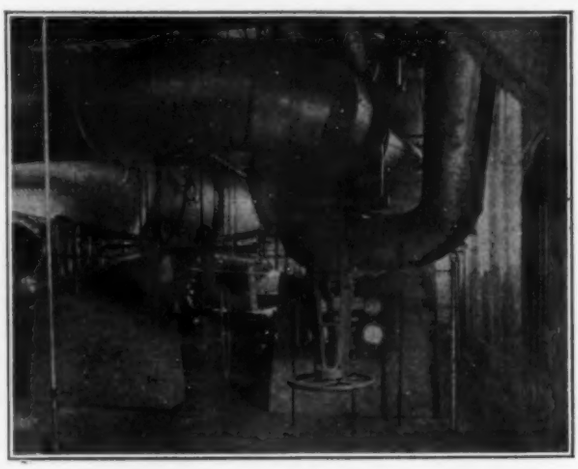
Strong, Compact and Quick Acting—these blast gates are ideally suited to a wide range of control operations including low pressure air, etc.

Rockwell Air-tight Blast Gates provide the full area of the line. Accurate and positive control assured because the slide "stays put."

Low initial cost plus ability to withstand the abuse of years of hard service, make Rockwell Air-Tight Blast Gates economical control units.

Write for Bulletin 282-E

W. S. ROCKWELL CO.
Industrial Heating Equipment
50 Church St., New York
(Hudson Terminal Bldg.)
Detroit Chicago Montreal
Members of Industrial Furnace Manufacturers Association



Installations Count!

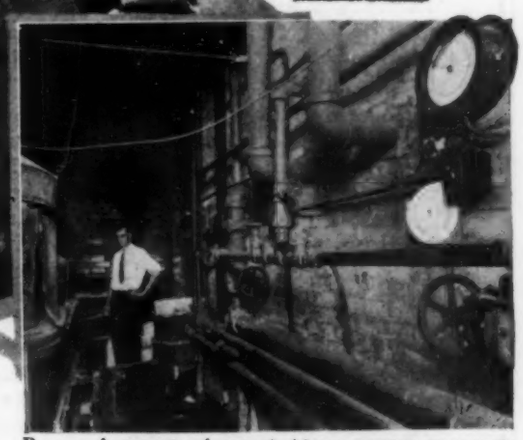
¶ View of two American Solvent Recovery adsorbers and connections in plant of Athol Mfg. Co., Athol, Mass., artificial leather manufacturers. These units recover 800 gal. of solvents daily from an exhaust of 12,000 cu.ft. of air per minute.

¶ Do you have a solvent recovery problem? May we cooperate in designing the most suitable plant to meet your peculiar conditions?

AMERICAN SOLVENT RECOVERY CO.
COLUMBUS, OHIO

14 Brown Automatic Control Pyrometers maintaining correct molten metal temperature at the plant of the Allied Die-Casting Corporation.

"To measure is to economize"



Brown Automatic Control Thermometer maintaining correct molten metal temperature in stereotype plate-making machine at the plant of The Atlanta Journal, Atlanta, Ga.

Problems in soft metal temperatures

THE principal problem in the utilization of molten soft metal is temperature. This holds good whether the job involves galvanizing stereotyping, die-casting or any one of other similar processes requiring the maintenance of proper fluidity in a hot metal bath. In all such applications Brown Automatic Temperature Control has proven very successful.

Says Mr. Dollin, President of the Allied Die-Casting Corporation: "If metal temperatures are too high, blow holes and oxidation result; if too low the metal will not properly fill the mold. Our 14 Brown Pyrometers automatically maintain the temperature at the correct point, saving time, labor, fuel and metal."

Write for Catalog No. 87 or special information for your requirements.

THE BROWN INSTRUMENT COMPANY
4478 Wayne Avenue Philadelphia, Pa.
Branches in 20 principal cities

Pyrometers, Flow Meters, Recording Thermometers, Gauges, Liquid Level Meters

Brown Instruments

" to measure is to economize "

Parks-Cramer

Industrial Heating by Oil Circulation

Chapter the Thirteenth

Jacketed Piping and Fittings

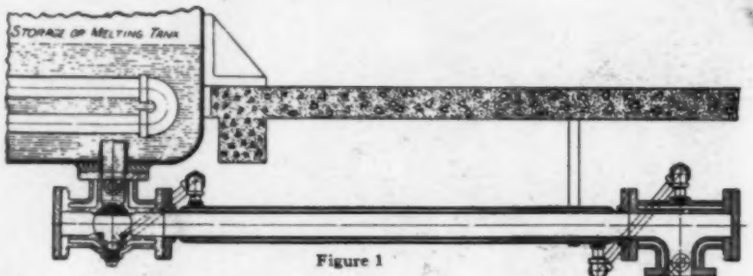


Figure 1

JACKETED Piping and Fittings are especially designed for the conveyance of asphalt, rosin, wax, sulphur, gums, syrups, and similar products which are viscous or solid at normal temperatures. In many plants the material has to be carried a long distance to the point of consumption and, in such cases, it is essential that it be maintained in a liquid state during transit.

Several crude methods have been used to accomplish this purpose, such as a perforated gas pipe with open flame placed beneath the single conduit itself, or a steam pipe paralleling the conduit, with both pipes in a metal enclosure. The first method was not only costly to operate, but objectionable because of the fire hazard and danger of damaging the product; the second method was limited to low temperatures due to the ineffective method of applying the heat.

Jacketed 3-Way Plug Cock

As the name implies, Jacketed Piping is an assembly of two pipes, one placed inside the other with an annular space between them through which the heating medium passes. Jacketed Fittings and Cocks are of rugged, flanged construction, with jackets cast integral.

The heating medium passes from one jacket to the other through jump-over connections as shown in Figure 1. High temperature circulating oil, steam or hot water may be used for heating, depending upon the temperature required.

From a study of the cuts, it will be noted that there is no possibility for the heating medium to leak into the product, or vice versa, a most important feature in the design of this equipment. Should a leak develop it would be outwardly visible and easily located.

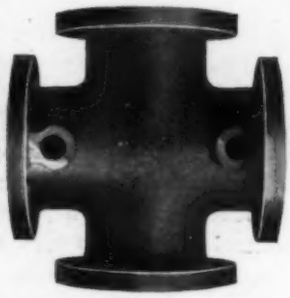
Jacketed Piping is made in sizes of $1\frac{1}{4}''$, $2''$, $3''$, and $4''$ inside diameter with the outer pipe of a suitable size to give the proper jacket space. The corresponding sizes of Jacketed Fittings include two-way and three-way Plug Cocks, Tees, 90° Elbows, 45° Elbows, Crosses, and Expansion Joints.

Many lines of Jacketed Piping and Fittings are in successful use in industries manufacturing chemical, electrical, molded, asphalt, confectionery, and other products. These industries use gilsonite, pitch, rosin, wax, sulphur, varnish, gums, pastes, heavy syrups, and other viscous or solid substances.

Send for our

Jacketed Piping Literature

Jacketed Tee



Jacketed Cross

Parks-Cramer Company

Engineers and Contractors - - Industrial Piping and Air Conditioning

1102 Old South Building, Boston, Mass.

Represented in England and on the Continent by The Kestner Evaporator & Engineering Company, Ltd., London, England

Take precious metal melting for instance—

ONE great difficulty has been the obtaining of uniformly homogeneous casts of precious metals, due to segregation while melting. For instance, under ordinary methods of melting, a piece of 22 karat gold might be perfect in appearance yet a piece clipped from one end might assay 21 karat and a piece from the other end 23 karat.

One of the greatest advantages in melting precious metals by the Ajax-Northrup method is the absolute prevention of the segregation of the alloys which in turn means homogeneous castings.

Add to this the advantages of fast melting, freedom from gases, comfortable working conditions, ease of operation and control, and it is easy to see why the Ajax-Northrup high frequency induction furnace is the logical furnace for melting precious metals and special alloys.

The whole story is in Bulletin 4—*Write for your copy.*

Ajax Electrothermic Corporation
Trenton, New Jersey

AJAX

AJAX NORTHRUP
ELECTRIC FURNACES

Have you a De-watering Problem???

THERE is no cheaper way to recover solids from water suspension or solutions than . . .

Centrifugal Spray Drying

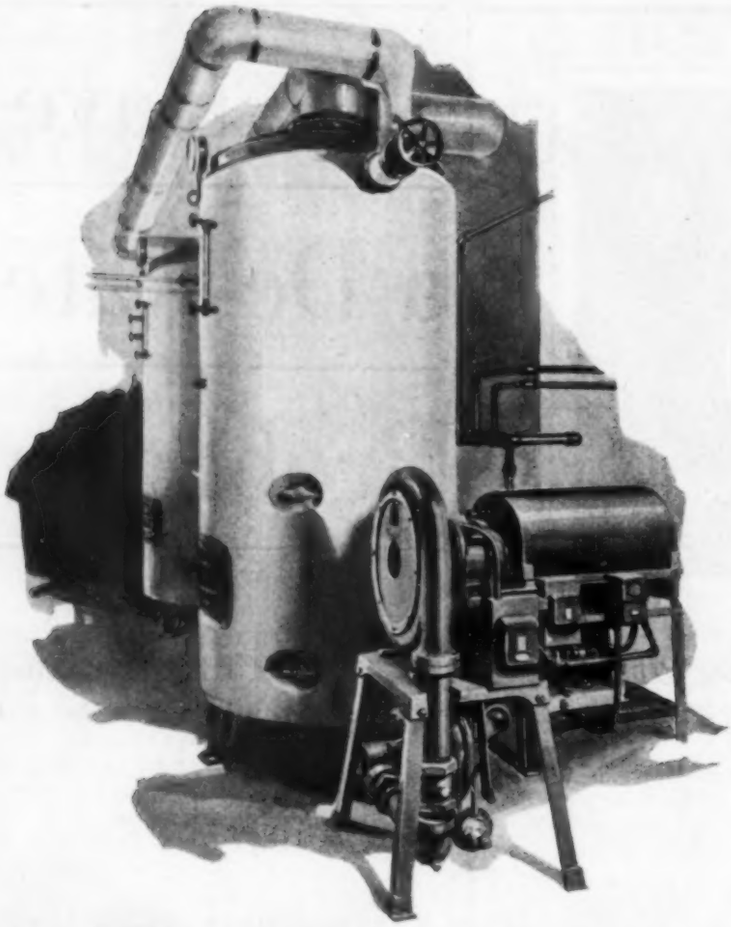
INDUSTRIAL ASSOCIATES' Centrifugal Atomizer will spray a mud or slurry. A current of hot air dries the water from the finely divided particles of spray while they are floating in the air. The particles, which are substantially dry when they strike the floor, are continuously removed.

Such problems as the recovery of solids from gas washer water are easily and cheaply solved by this apparatus.

Foods, soaps and chemicals can be dried as powders at minimum cost.

Let our Engineers help solve your drying problems

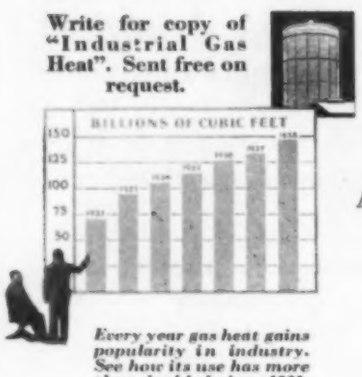
INDUSTRIAL ASSOCIATES
INCORPORATED
101 Park Avenue New York City



GAS HEAT *is better for steam boiler firing*

The working efficiency of a steam boiler depends largely upon the efficiency of the firing. Gas heat provides maximum speed of flame propagation and a full head of steam without loss of time. And the accurate controllability of gas assures efficient temperature regulation without waste. That's economy . . . .

Write for copy of "Industrial Gas Heat". Sent free on request.



Every year gas heat gains popularity in industry. See how its use has more than doubled since 1921.

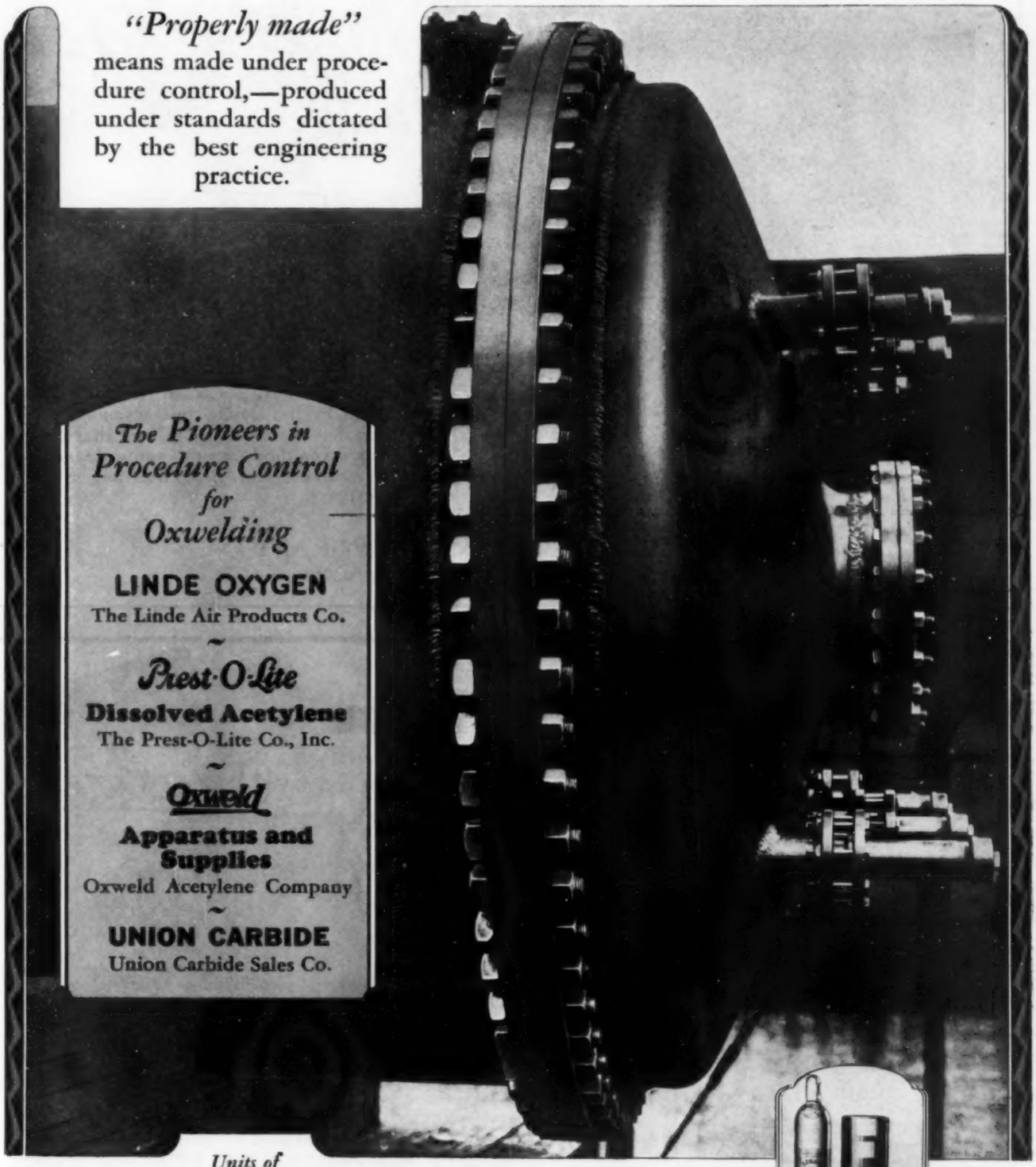
AMERICAN GAS ASSOCIATION
420 Lexington Avenue, New York

If It's Done with Heat,
You Can Do It Better with

GAS

"A properly made oxy-acetylene welded joint is as strong as the base metal, fully 100% efficient . . . ."

"Properly made" means made under procedure control,—produced under standards dictated by the best engineering practice.



The Pioneers in Procedure Control for Oxwelding

LINDE OXYGEN
The Linde Air Products Co.

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Prest-O-Lite
Dissolved Acetylene
The Prest-O-Lite Co., Inc.

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Oxweld
Apparatus and Supplies
Oxweld Acetylene Company

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UNION CARBIDE
Union Carbide Sales Co.

Units of

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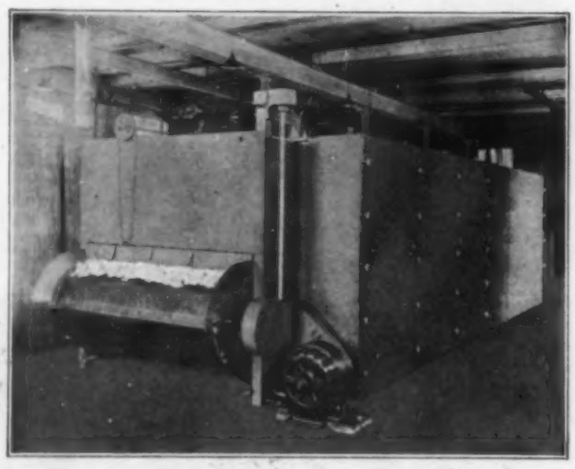
64 Linde Plants—45 Prest-O-Lite Plants—154 Oxygen Warehouse Stocks—138 Acetylene Warehouse Stocks—38 Apparatus Warehouse Stocks—235 Carbide Warehouse Stocks

Now is the time to put Eveready Prestone, the perfect anti-freeze, in your automobile radiator—Eveready Prestone is guaranteed by National Carbon Company, Inc., unit of Union Carbide and Carbon Corporation.

FIDALGO DRYING SYSTEMS

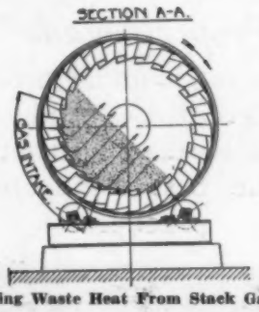
FIDALGO DRYER
FOR WOOD AND COTTON PULP



Shredded Pulp Dried With Same Strength As Wet

Dryers for wall and insulating board.
Let us know your problem.

THE NEW PEHRSON DRYER



Utilizing Waste Heat From Stack Gases

BRIEF DESCRIPTION OF DRYER

The hot gases are introduced over that portion of the periphery of a rotating drum which is immediately beneath the material composing the bed, and the rising gases pass through the bed, completely surrounding every particle of it. It will readily be understood that, by this means, full advantage is taken of the sensible heat of the gases, **and that by no other known method can the same degree of intimate contact and high thermal efficiency be ensured.**

TECHNICAL ECONOMIST CORPORATION
122 East 42nd St., New York City, N. Y.

A New Bayley Bulletin
Is Ready For You!

A NEW BAYLEY BULLETIN, containing complete information on Bayley Chinookfin Heaters, is now ready for you. To the engineer or executive who has the responsibility of selecting or specifying indirect heaters for heating, ventilating, air conditioning, process drying, tempering coil or other service, this new bulletin will prove a valuable reference book.

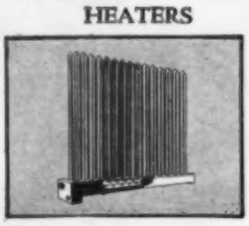
Chinookfin Heaters possess remarkable features; a copper indirect radiator as safe for tempering coil service as for reheaters — a single header divided into steam and return chambers — individual radiating tubes with individual feed through individual circulating pipes. Write for Bulletin No. 29-C which describes the Chinookfin in detail.

BAYLEY BLOWER COMPANY,
772 GREENBUSH ST., MILWAUKEE, WIS.
Representatives in Principal Cities

Bayley
Established 1883

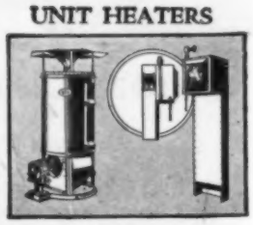
FANS

HEATERS



AIR WASHERS

UNIT HEATERS



HEATING — VENTILATING — AIR CONDITIONING — PROCESS DRYING — MECHANICAL DRAFT — EXHAUST

1600° Within This Range Use Armstrong's Brick 2500°

A LARGE class of industrial furnaces used to be considered outside the range of insulation because of the high temperatures carried. Most of them can now be insulated safely. Armstrong's Brick withstand a direct heat of 2500° F. back of the refractory which means, of course, much higher temperatures in the combustion chamber.

It is no longer a valid objection to say, "The insulation won't stand it." Armstrong's Brick do "stand it," without shrinking, cracking, warping, or spalling, and without losing any of their insulating value. Moreover, when rebuilding or relining, Armstrong's Brick are not "scrap," but can be used again.

Have you a problem in high temperature insulation? Write for details of performance and get an Armstrong Brick and test it. Full information and sample sent on request. Armstrong Cork & Insulation Company, 919 Concord Street, Lancaster, Pennsylvania.

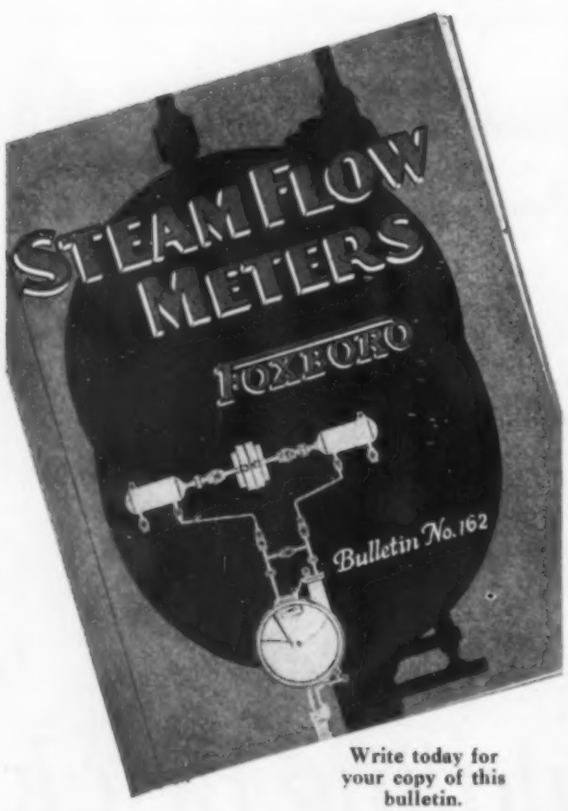
Armstrong's Insulating Brick

For Furnaces and Boiler Settings

GOOD

Foxboro Announces a New Instrument

An Accurate Mechanical Steam Flow Meter



Write today for your copy of this bulletin.

Foxboro now offers to steam users a new steam Flow Meter — a meter which changes the whole conception of what constitutes accuracy in steam flow measurement.

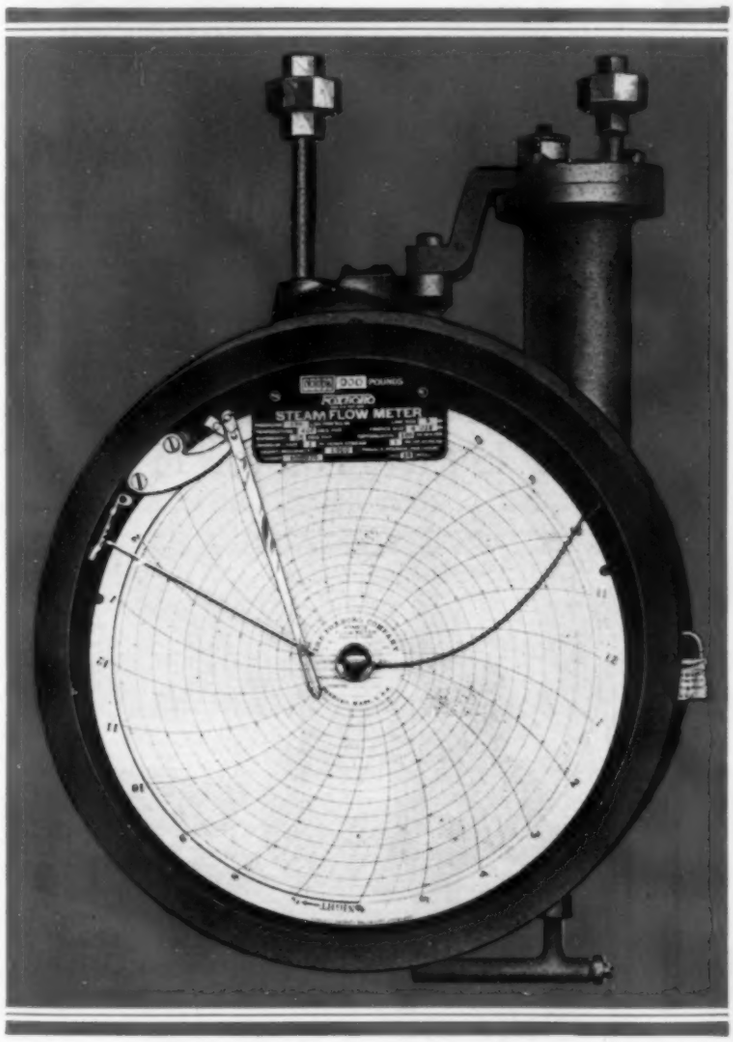
It is fundamentally accurate and, what is more important, it is *consistently* accurate in daily operation.

In three years of field tests it has won the enthusiastic approval and acceptance of leading authorities on steam measurement.

Its tremendous acceptance by engineers proves that it meets the demand for a simple dependable meter.

INSTRUMENTS *for* CONTROLLING, RECORDING *and* INDICATING

NEWS



The Foxboro Steam Flow Meter is equipped with an integrator that reads direct, without multipliers, the total pounds of steam.

It is a simple, strong, accurate, fool-proof, mechanical meter.

Friction is reduced to a minimum. No special compensators, balances or stuffing boxes are used.

Readings are based on an entirely new set of steam flow coefficients developed by Foxboro through two years of extensive research and test.

Workmanship, permanent calibration and satisfactory performance are guaranteed.

See our exhibit at the New York Power Show, Grand Central Palace, December 2-7.

Booths 403-404.

THE FOXBORO COMPANY
Neponset Avenue, Foxboro, Mass., U. S. A.

New York, Chicago, Boston, Philadelphia, Detroit, Pittsburgh, Cleveland, Rochester, N. Y., Tulsa, Atlanta, Los Angeles, Dallas, Portland, Ore., San Francisco, Salt Lake City

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FOXBORO
REG. U.S. PAT. OFF.
THE COMPASS OF INDUSTRY

TEMPERATURE, FLOW, HUMIDITY *and* PRESSURE

What Does Guesswork Cost You?

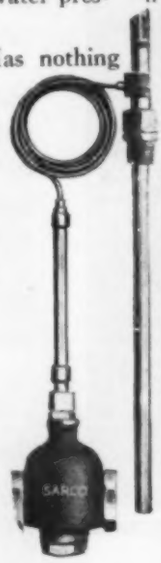
Adjusting valves by hand cannot be depended upon for accuracy in maintaining correct temperatures. At best, this method can be only approximate. The most skilled men can do no more than *guess*—and it is human nature to forget.

Sarco Temperature Regulator puts a stop to guesswork. Once set for a given temperature it maintains *that* temperature *always*. It never varies.

The Sarco is inexpensive to buy and to install. No expensive pipe lines needed. It is entirely self-contained. Requires no compressed air, water pressure or electricity to operate.

Is also inexpensive to maintain. Has nothing to get out of order.

Works on steam, gas or hot water heat within any range between 30° and 300° F.



Test It 30 Days Free

Put Sarco on the job for 30 days. If it does not prove its case, return it and don't pay us a penny.

Write for Booklet AF-70.

SARCO CO., Inc.
183 Madison Avenue, New York

Boston, Buffalo, Chicago, Cleveland, Detroit, Philadelphia, Pittsburgh, St. Louis

Sarco (Canada) Limited
1605 Delorimier Ave., Montreal

SARCO Temperature Regulator

Sarco Co., Inc.,
183 Madison Ave., New York City

☐ Send a Sarco Temperature Regulator on 30 days' free trial.
☐ Send Booklet No. AF-70.

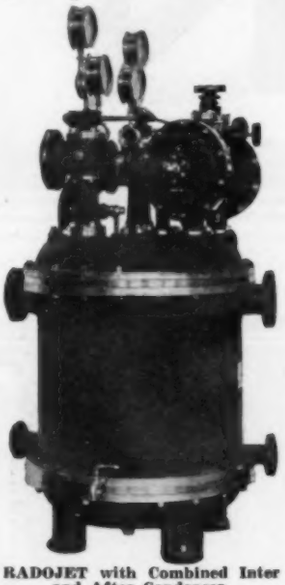
Firm .....

Street .....

City ..... State .....

RADOJET

...gives maximum Vacuum using minimum steam



RADOJET with Combined Inter and After Condenser.

C. H. Wheeler Manufacturing Co.
19th St., Lehigh and Sedgley Aves.
Philadelphia

C. H. WHEELER of PHILADELPHIA

For Quick Evaporation

The high rates of heat release obtained in the new

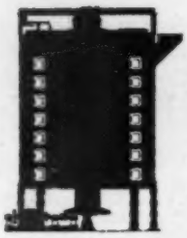
Zeitler Sanitary Evaporator

are due to correct design of the removable heating element, that can be rolled in and out of the shell in a few minutes, when cleaning becomes necessary.

The evaporator is constructed of stainless steel, Monel Metal, nickel or copper, according to requirements. Capacities range from 500 to 5000 lb. of water evaporation per hour.

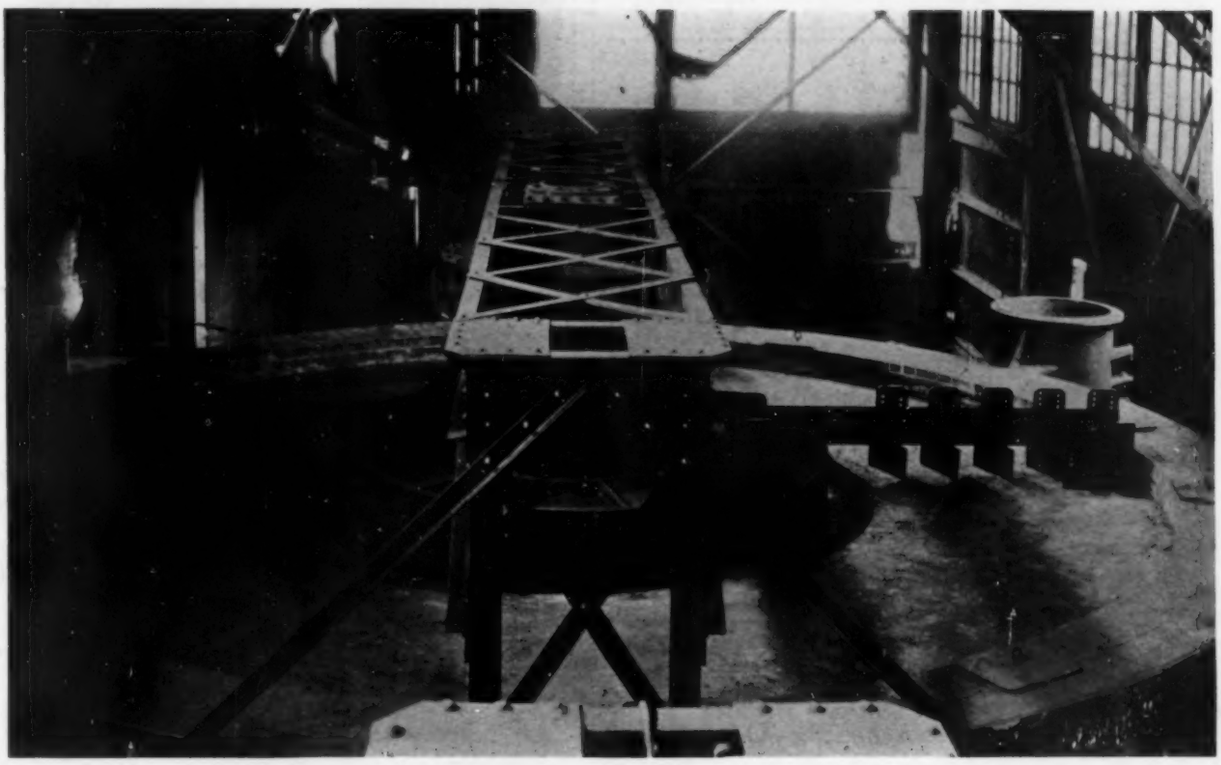
WRITE FOR COMPLETE DESCRIPTION.

Oakland Copper & Brass Works
1346 7th Street, Oakland, Calif.



To those who have a drying or roasting problem

Drying or Preheating hearth of a Wedge Mechanical Roasting Furnace.



Many worth-while economies are being affected in progressive industrial plants through the use of the Wedge Roasting Furnace. Many of these furnaces of special design have been installed in petroleum refineries to calcine or revivify used Fullers Earth. Others are operating in sugar refineries, regenerating or revivifying diatomaceous earth (Kieselguhr). And now industrial plants everywhere having a drying or roasting problem are thoroughly investigating the advantages of the Wedge Roasting Furnace.

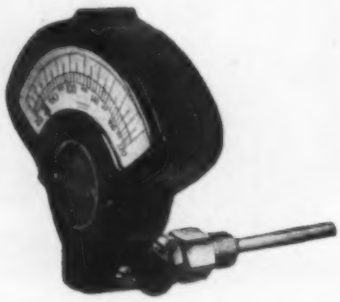
If you are confronted with a stubborn roasting or drying problem, it will be well worth your while to make an investigation of this roasting furnace's many features. Our engineers will be glad to assist you in this work. Or, if you desire additional information, write for Catalog F-1.

● BETHLEHEM FOUNDRY *and* MACHINE COMPANY, Bethlehem, Pa. ●

WEDGE Roasting Furnaces

Other Products include: Chemical Equipment of all kinds, Original Frederking Apparatus, Castings of Iron, "Tantiron" and Special Irons, Special Machinery, Cement Plant Machinery, "Stellited" Parts, etc.

Keep Your Eyes *on* Temperature



Motoco

Industrial Thermometer

MORE, and more efficient check on temperature is the present-day way to keep maintenance cost down, and to insure uniformity of product.

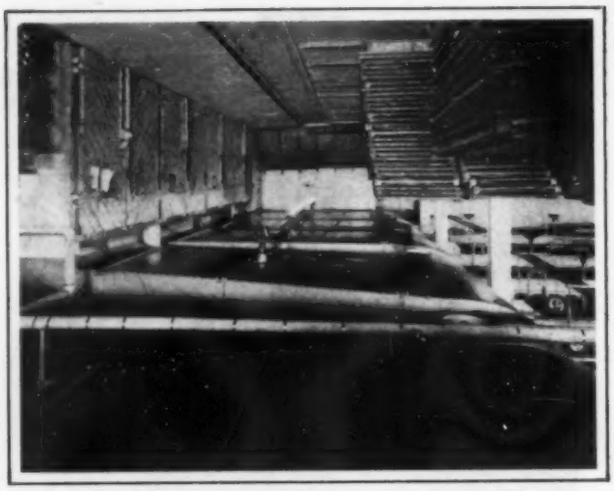
The accurate—dependable—vibration proof—clear reading—easily installed—MOTOCO Industrial Thermometer widens the field for use of thermometers—now every critical point can be watched.

MOTOCO Dials are the kind that will be read and read accurately. Their convenience INSURES WATCHFULNESS. They can be read at a distance. They can be located away from their bulbs or set at any angle that is convenient for reading.

MOTOCO Industrial Thermometers can be used with steam, gases or corrosive liquids. They are accurate for any range of temperature from minus 40° to plus 750° F. They are adaptable for special needs. They will operate an alarm or electric control. They are a product of

MOTO METER

GAUGE & EQUIPMENT CORPORATION
8 Wilbur Avenue, Long Island City, N. Y.



Production Figures Tell the Story

Production figures tell the story of what Sturtevant Dryers accomplish . . . a story of shortened drying schedules, lowered operating costs and high quality production. These outstanding results are responsible for the acceptance of Sturtevant Drying Equipment as standard in the various industries.

The drying requirements of some products necessitate specially designed equipment to obtain the highest operating efficiency. In cases of this kind Sturtevant engineers determine the design of the equipment through laboratory tests and research. This service assures manufacturers of apparatus that will meet the specific requirements with utmost economy.

Whatever your immediate or future requirements may be . . . new equipment, remodeling old apparatus or extending present facilities . . . Sturtevant engineers can give you invaluable assistance. Have one of them call and explain the advantages of Sturtevant Drying Equipment.

B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASS.
Sales offices in all principal cities

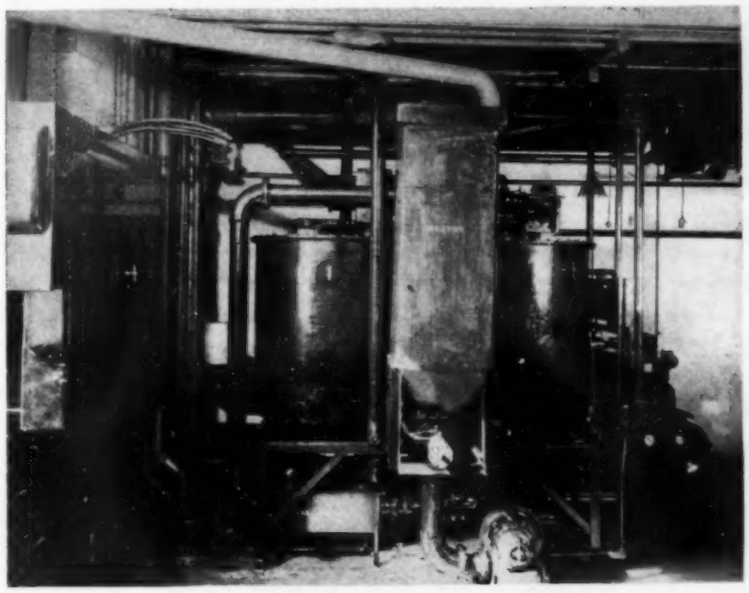
Sturtevant
(REG·U·S·PAT·OFF·)

Drying Equipment

For Drying and Purifying Compressed Gases

SILICA GEL

Cuts Costs—Improves quality



SILICA GEL drying by absorption mechanically, not chemically, is assuming an important function in the drying and purifying of compressed gases. The equipment necessary is simple and economically operated and the Silica Gel can be used over and over again, lasting indefinitely under proper working conditions.

MANY gases when dehydrated and purified, have a much greater efficiency and consequently enhanced commercial value. The use of Silica Gel also prevents corrosion of shipping cylinders and valves, and eliminates the use of caustic. Full details are contained in an illustrated treatise "Bulletin No. 6," which we will be glad to send you.

Used to Dry:

Compressed Air	*Hydrogen*	*CO_2*
Air for Liquefaction	*Oxygen*	*SO_2*
Chlorine	*Acetylene*	*etc.*

Write for Bulletin No. 11

THE SILICA GEL CORPORATION

1100 Garrett Bldg., Baltimore, Md.

Radial Brick Chimneys for INDUSTRIES using CHEMICAL PROCESSES

Acid Proof Chimneys Handling ACID GASES

For Smelters, Chemical Works, Paint Works, By-Product Coke Ovens. **ALSO** for **BOILERS.** Ovens and Furnaces. All Sizes.

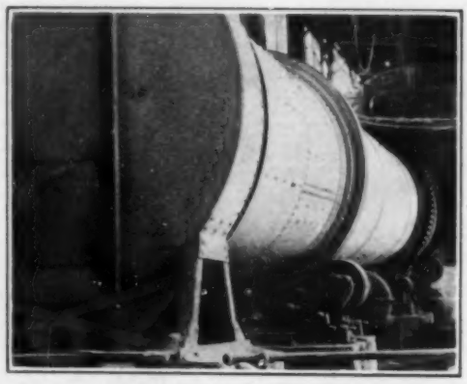
Built of Impervious Radial Brick

Also Builders of

Reinforced Concrete Chimneys

Send for Free Booklet CM7 "Construction and Design of Chimneys Subjected to Acid Gases."

ALPHONS CUSTODIS CHIMNEY CONS. CO.
95 Nassau St., New York **Marquette Bldg., Chicago**



One of our 8-ft. 6-in.x65-ft. Dryers in a Cement Plant
Christie Dryers are made in various designs to fit any specific need.

Your **success depends on the selection of Proper Equipment.** ***Our*** **success depends on supplying YOU with Proper Equipment**

We design and manufacture
CHRISTIE ROTARY DRYERS AND CALCINERS
SHAFT OR ROTARY LIME KILNS
MECHANICAL AND HAND-POKED GAS PRODUCERS
STEEL TANKS AND STACKS
STEEL PLATE CONSTRUCTION OF ALL KINDS

Adopt Our Recommendations
They're Safer

DUFF PATENTS CO., INC.
320 Union Trust Bldg., Pittsburgh, Pa.

Can Drying Efficiency Be Improved in Your Plant?

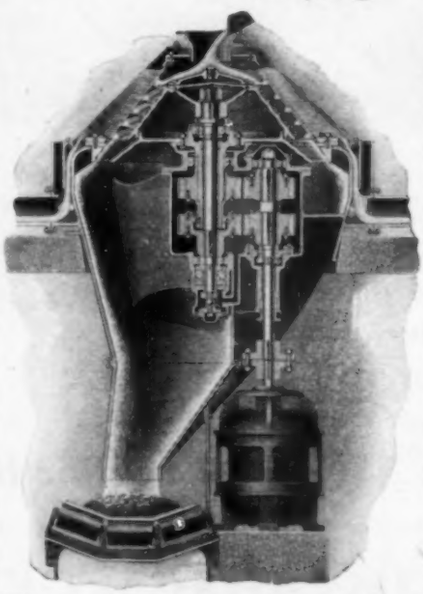
"HURRICANE" Truck Tray Dryer of the Type Used for Lithopone, White Lead, Dry Colors, Oxides, Dyes, Copra, and Pharmaceuticals.

1. **Are all drying operations under positive control, regardless of outside conditions?**
2. **Are the particular temperatures employed conducive to both a high quality product and to economical production?**
3. **Is a system of air circulation employed, and if so is the air circulated in the most efficient manner with regard to: heat consumption, drying speed and uniformity of drying?**
4. **Could labor and time be saved with an automatic, or progressive, type of dryer?**

These important questions can be answered by a "HURRICANE" Drying Engineer, who will gladly visit your plant to make a survey of your drying problems.

THE PHILADELPHIA DRYING MACHINERY CO.
3351 Stokley Street, Philadelphia, Pa.
New England Office—53 State St., Boston, Mass. 153

ELMORE CONTINUOUS CENTRIFUGALS Make Startling Economies in Drying



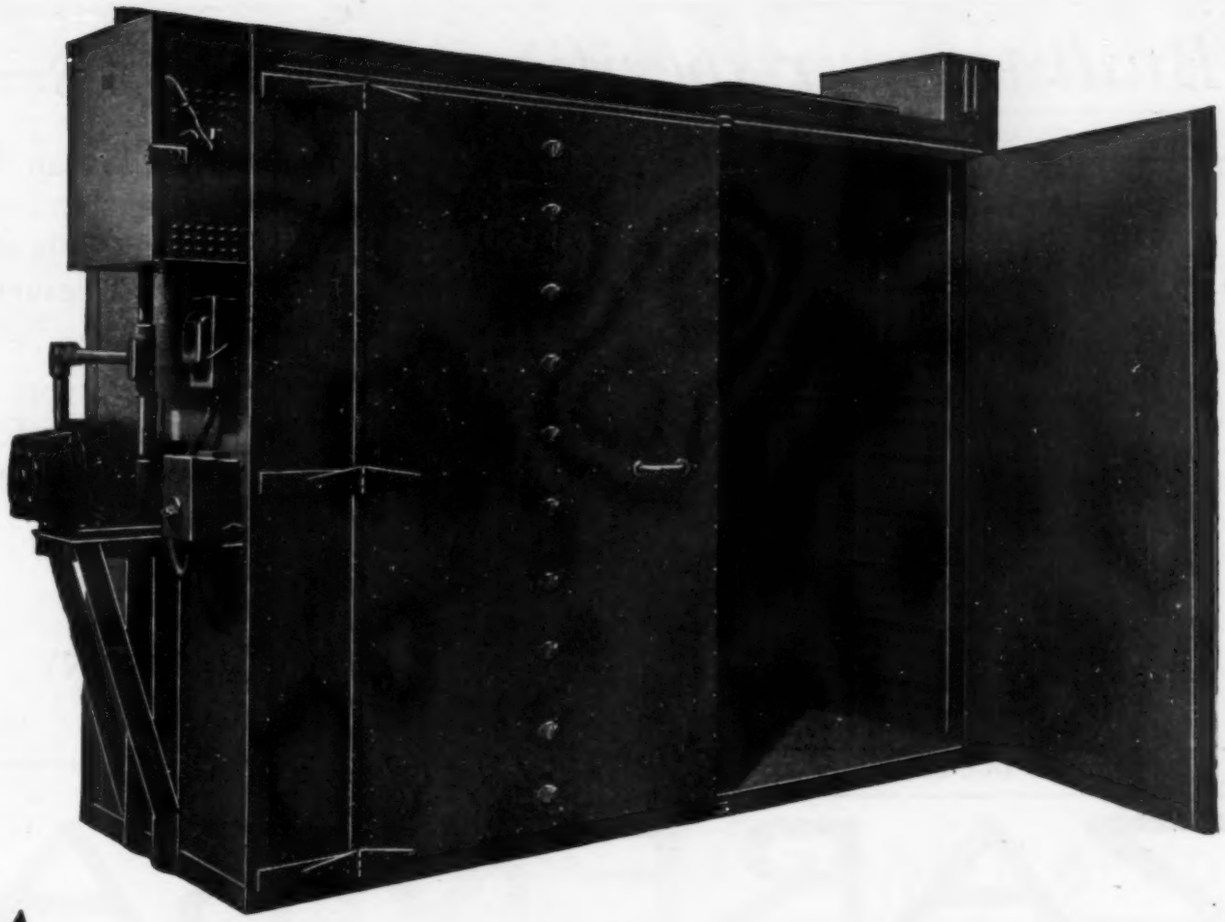
Handling three to ten times the tonnage of batch type centrifugals of similar basket diameter, the Elmore is a decided economy over other methods of deliquefying chemicals.

To manufacturers having a drying problem the Elmore offers a worthwhile saving in labor, in power, in floor space, in cost of maintenance and depreciation.

Write for complete information. Our testing laboratory is at your disposal.

Elmore Centrifugal Products Corporation
6525 Manchester Ave., St. Louis, Mo.

ELMORE



A variable range of temperatures easily and accurately obtained

ACCURACY with flexibility are combined features of Freas Electric Ovens and Dryers. Their operating range is from slightly above room heat to 700° F.; their accuracy of temperature control is within 2° equally effective at every point; and a twist of a knurled thumb screw is all that is necessary to set the regulator to maintain automatically any desired temperature.

They are also equipped with a motor-driven forced-air-circulating system, which provides an even heat in all parts of the service chamber, insures uniform results, and accelerates drying operations.

Sound engineering principles and practical experience are embodied in every detail of their design and construction. High operating efficiencies and thoroughly dependable performance are predominant characteristics.

In comparison with fuel and gas fired or steam heated ovens—economic and production advantages are overwhelmingly in favor of Freas Electric Ovens and Dryers—for they admit of faster production, and operate with greater economy.

Freas Electric Ovens and Dryers are made in standard and semi-standard sizes, and are also built to meet specific needs. We shall be pleased to submit facts and figures and any definite information you may desire.

FREAS THERMO-ELECTRIC COMPANY

FREAS

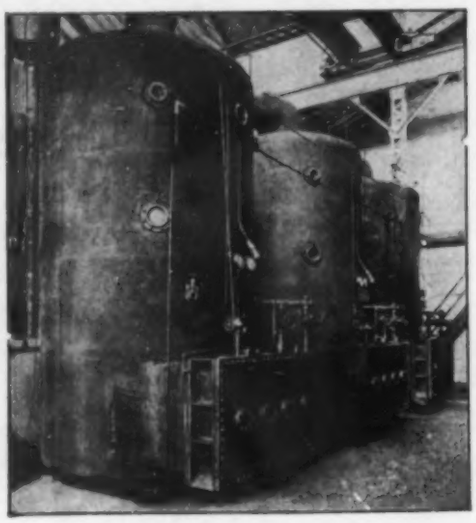
ELECTRIC HEAT AUTOMATICALLY CONTROLLED

1209 SOUTH GROVE STREET
IRVINGTON, N. J.

Electric Industrial and Laboratory Ovens

Built to your specific requirements—

ACETATE OF LIME



Bodies 84-in. Diameter

"Zaremba," now and always, will mean the best equipment for concentrating solutions, because each Zaremba Evaporator is designed by experienced engineers to exactly suit conditions.

With twelve thoroughly developed types to select from Zaremba Company always furnishes the best evaporator for the purpose.

SINGLE EFFECT, MULTIPLE EFFECT and RECOMPRESSION EVAPORATORS

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ZAREMBA

THE BABCOCK & WILCOX COMPANY

85 LIBERTY STREET, NEW YORK

Manufacturers of

Water-Tube Boilers, Steam Superheaters, Air Preheaters, Economizers, Chain Grate Stokers, Oil Burners and Refractories. Pressure Vessels and Special Process Equipment

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HOUSTON, TEXAS, Electric Building
LOS ANGELES, Central Building
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PHOENIX, ARIZ., Heard Building
PITTSBURGH, Koppers Building
PORTLAND, ORE., Failing Building
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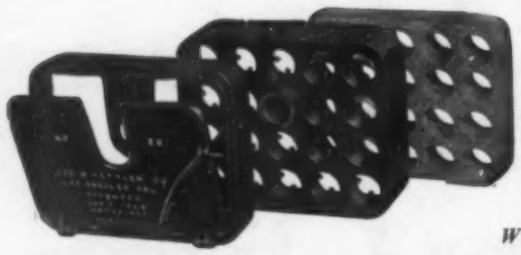
SAN JUAN, PORTO RICO, Recinto Sur 51

METTLER ENTRAINED COMBUSTION GAS BURNERS



are guaranteed to produce the best results obtainable from combustion of gas (city gas, coke oven gas, natural or still gas). Since all the air for combustion is taken in through the burner itself, either reducing, neutral or oxidizing flame can be obtained by adjusting the front damper. Mettler Burners are suitable for all kinds of boilers, heat treating, process, high or low temperature furnaces, etc.

Write for Catalogue.

LEE B. METTLER CO.

406 S. Main Street LOS ANGELES, CALIF.

FRACTIONATION

With a throughput rated conservatively at 30,000 gal./24 hr., this BRAUN fractionator yields a maximum of Grade A gasoline. We can select with certainty the apparatus required to solve your specific fractionation problem.

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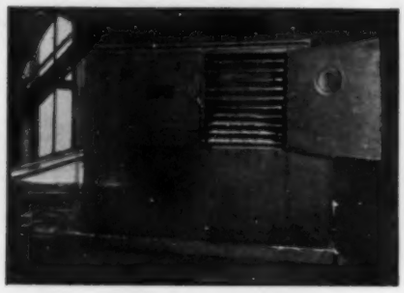
—LIMITED—
ALHAMBRA, CALIFORNIA

NEW YORK 120 Broadway · **HOUSTON** Neils Esperson Bldg
TULSA Kennedy Bldg · **SAN FRANCISCO** Russ Building

Truck System Dryer



Small Tray Dryer

DRYING IN MANY INDUSTRIES

Proctor Dryers in a variety of types serve the drying needs of many different industries.

You find these machines taking a leading part in the drying of chemicals, paint colors, white lead, pharmaceuticals, ceramics, brick, refractories, grinding wheels, leather, soap, tobacco, veneer, wool, cotton, silk, rayon, hair, fur, yarn, cloth, hosiery, carpet, food products...in fact, nearly all materials dried in process of manufacture.

Proctor engineers have specialized in building drying machinery for forty-five years. They have acquired an unparalleled experience . . . and the benefits of experience are expressed in the advanced design of Proctor Dryers and the economy attained in their operation.

Proctor experience is being regularly and successfully applied in solving new problems of drying economically in industry — a service available without fee or obligation to any manufacturer interested in drying, to best advantage, any kind of material.

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for use in

Boilers	Glass Lehrs
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A SUPERIOR product produced with the greatest fuel economy whether it be the burning of the largest rotary kiln of lime or the case hardening of the smallest of steel pieces.

Your inquiries for Oil Burning Equipment are solicited.
Write for catalog showing oil burner application to your type of equipment.

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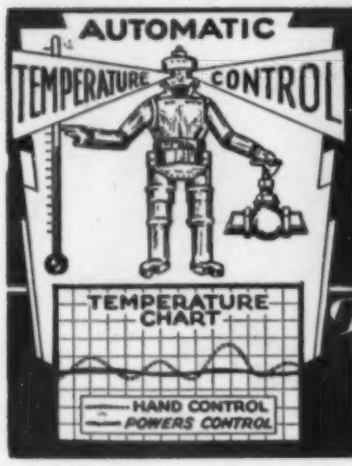

35 Years of Specialization in Temperature Control

To Err is Human —to eliminate the occasional errors of hand control of temperature with the mechanical accuracy of a Powers Regulator not only speeds up production—but secures a still better and more uniform product. Let our engineers study your problems of temperature control and recommend the type of regulator that will give best results at lowest cost.

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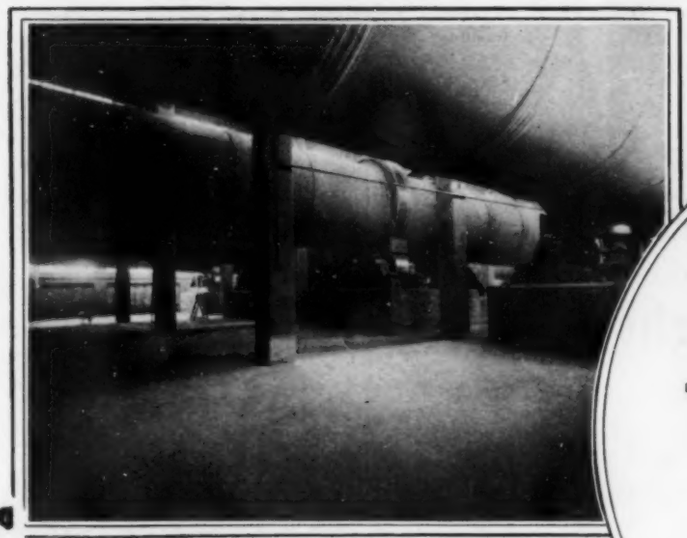
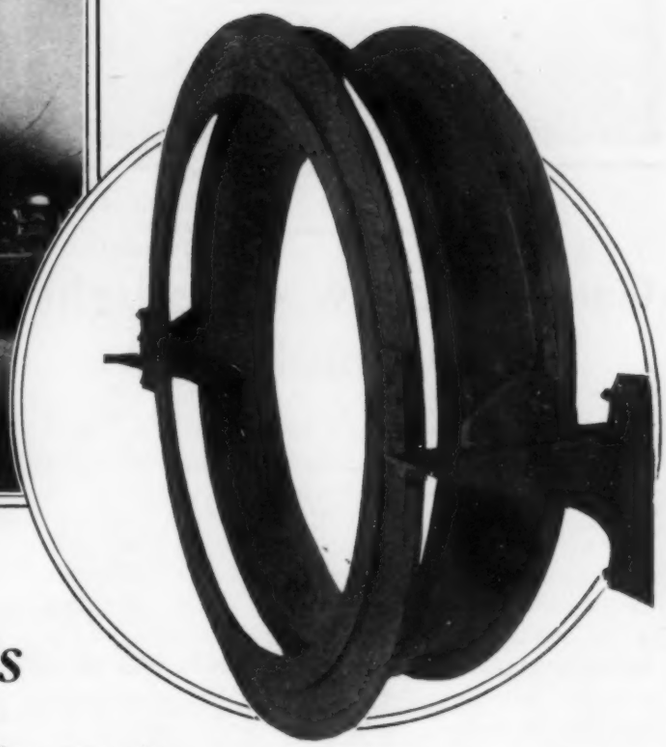
The POWERS REGULATOR CO.

Huron Seal Rings





for Rotary Kilns and Rotary Dryers

The degree of success with which combustion gases in rotary kilns and dryers can be conserved at maximum temperature depends upon the effectiveness and reliability of the rings that seal the kiln or dryer.

If cool air is drawn into the kiln or dryer it reduces the temperature of the gases. Therefore the kiln must be sealed from outside air as completely and continuously as possible in order to maintain the maximum temperature.

Huron Seal Rings, for rotary kilns, dryers and coolers, are so designed as to effect a most efficient seal against the loss of heat. Employing the Gravity principle, no springs or mechanical devices are required in the assembly. Simple in design, and easy to install, they insure a definite saving of heat and successful operation under all conditions year in and year out.

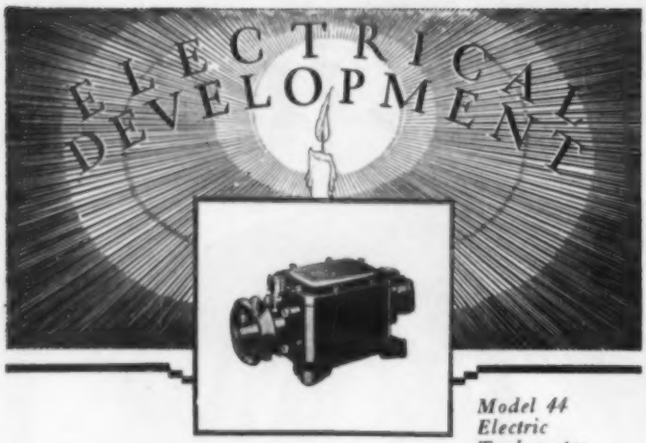
Huron Seal Rings have MADE GOOD. Write for Catalog.

Save ALL the Heat!

For absolute dependability, Huron Seal Rings are unequalled. Once installed, nothing can possibly prevent its maintaining a 100% seal at all times, thereby keeping and assuring a positive seal from cold free air and maintaining proper regulation of air necessary for correct burning or drying. When other types of seals are wearing out or requiring constant attention and adjustment, the Huron Gravity Seal Ring will still be operating—even to the full life of the kiln or dryer itself. No maintenance whatever is required—which fact alone accounts for a considerable saving in plants operating a number of kilns and dryers.

HURON INDUSTRIES, INCORPORATED
1440-1442 Builders Building, Chicago, Illinois
Plant at Alpena, Michigan

HURON Seal Rings
for ROTARY KILNS-DRYERS-COOLERS



Model 44 Electric Tachometer

Can we throw some light on *your* problems?

NO single swallow makes a summer—nor does a single instrument go farther than a candle's feeble glow to lighten the problems of Electrical Development.

Take any Weston Instrument—any model or range. The most complete description possible would fail to convey a full conception of its probable uses. The needs of electrical measurement are too numerous and varied for even an attempt at classification with respect to the application of a single instrument or, for that matter, Weston's complete line of instruments.

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But Weston research, manufacturing and consultation facilities are available to all. Engineering and sales representation in all the principal cities of the world affords convenient points of contact with instrument headquarters, so that your problems *can be brought to us* for study and solution. If the abridged listing in our catalog does not cover the instruments you require, we shall be glad to receive your communication and will give it prompt attention.

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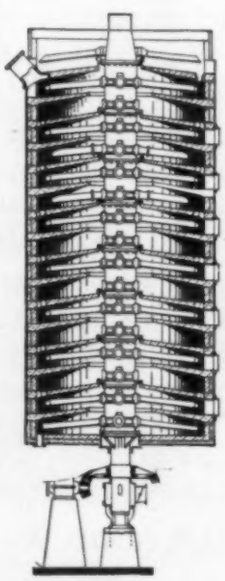
Years of experience in the refractory porcelain business plus a large number of tests of actual operation assure you that McDanel Products are right in every respect. In these tests, McDanel Tubes have proven to be far superior to various other makes. It will pay all pyrometer users to specify McDanel Tubes with their instruments or next replacement order from their instrument makers.

We have also developed a very successful combustion tube for carbon determination which has met with marked success.

TRADE MARK

McDanel Refractory
Porcelain Co.
Beaver Falls, Pa.

Write for complete information on McDanel Products.



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DRYING

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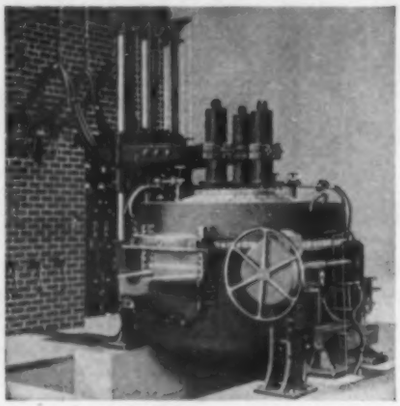

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RAPID

MOORE *Lectromelt* FURNACES

The most rapid and economic electric furnaces for the production of gray and malleable irons, carbon and alloy steels. Special furnaces for ferro-alloys, carbide, etc.

Built in standard sizes from 50 pounds up to 12 tons per hour.

Now about 250 'LECTROMELTS in regular operation.

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PITTSBURGH ELECTRIC FURNACE CORPORATION

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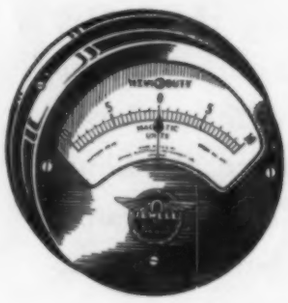
WORLD'S LARGEST MANUFACTURERS OF ELECTRIC FURNACES EXCLUSIVELY

KNOW

when you reach AC_2



When steel, heated in a furnace equipped with the AC_2 indicator, reaches the AC_2 point the pointer of the above instrument returns to zero. Complete details describing this more positive method of heat treating will be furnished upon request.

Who measures, knows!

Hevi Duty Electric Co.

Milwaukee, Wisconsin

The Melting Pot of the Nation

So popular has the Dixon Crucible become, on account of its durability and reliability, that it can rightfully be called "The Melting Pot of the Nation"

There are few melters of metal in America who do not recognize the superiority of the Dixon Crucible.

First in America, not only from the standpoint of age, but quality also.

Write for list of sizes and prices and Booklet No 51-A.

Made in JERSEY CITY, N. J., by the

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ESTABLISHED 1827

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OBNOXIOUS VAPOR CONDENSERS

kill the bad odors in process gases

They operate with pressure water, induce rapid flow of vapors and discharge to sewer, stack, or absorption chamber.

11 standard sizes, 3″ to 60″.

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New edition of bulletin 4-R now ready

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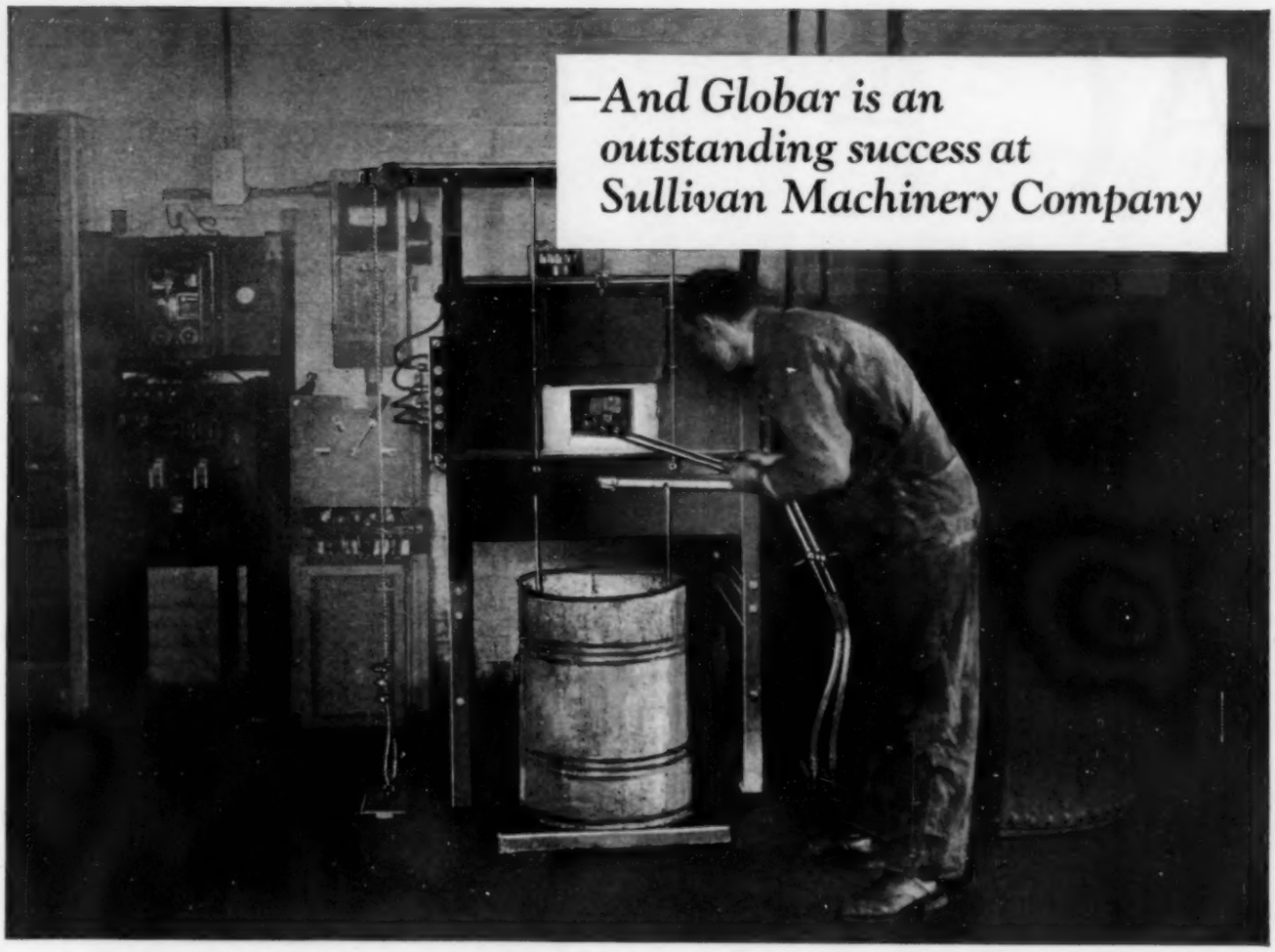

—And Globar is an outstanding success at Sullivan Machinery Company

IN the improved heat treatment of high speed steel at this great plant, Globar Brand Non-Metallic Heating Elements play an all important part.

Globar Elements are used in the C. I. Hayes, Inc. furnaces. The treating is done under atmospheric control. Accurate temperatures are maintained—less time is required to bring the furnace up to heat.

But most important of all is the production of better treated pieces and the elimination of scale and burning. The absence of stray heat makes for improved working conditions.

The complete ease of replacement of Globar Elements precludes the possibility of costly, long shut downs, because—

You can take out the old, put in the new element in a matter of moments—no tearing down of the furnace—no delay in furnace operation.

A Globar Element can be renewed while the furnace is still at heat.

[Our Sales Engineers will gladly tell you how you can use Globar Brand Elements in your plant]

GLOBAR CORPORATION, NIAGARA FALLS, N. Y.

(A SUBSIDIARY OF THE CARBORUNDUM COMPANY)

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RUBBER LINED TANKS

for process industries are obtainable in almost any size or shape. Our facilities efficiently handle the smallest special rubber lined jobs as well as one piece lined and covered Tanks, up to 11 ft. in diameter and 25 ft. long. Sectional tanks 60 ft. long, ACE Rubber Lined, are in service. ACE Rubber Lining can be applied to sectional tanks any length.

A Patented Feature of ACE Hard Rubber Tank Linings

The unexposed inner layer of soft rubber expands and contracts with temperature changes without loosening the bond between the Hard Rubber and steel. Furthermore, it acts as a shock absorber.

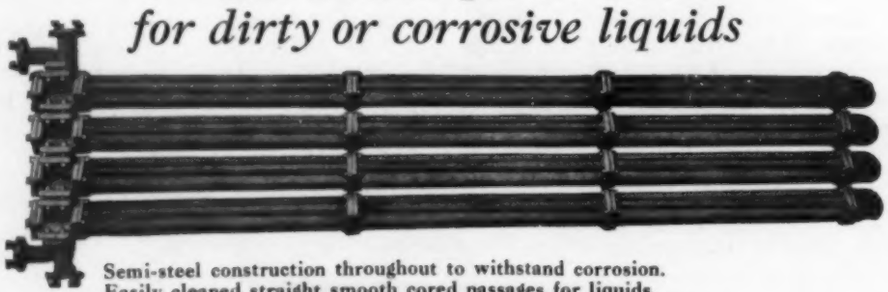
Available products include ACE Rubber Lined Pumps; Pipe; Fittings and Valves. Hard Rubber Pipe, Fitting, Utensils. ACE Flexible Pails and Hard Rubber Dippers. Special molded articles. Our Engineers will gladly work with you. Literature on request.

AMERICAN HARD RUBBER COMPANY, 11 Mercer St., N. Y.

The G-R Tubeflo Section—

(Patent Applied for)

A heat exchanger or cooler for dirty or corrosive liquids



Semi-steel construction throughout to withstand corrosion.
Easily cleaned straight smooth cored passages for liquids.
Can be arranged in stacks for flexible capacity and cooling effect.
High salvage value because readily dismantled, transported and re-erected.
Quick shipment of standard and interchangeable sections.

Write for full information.

The Griscom-Russell Co., 285 Madison Ave., New York

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Heat Transfer Apparatus

Wood Tank Cars

an asset to transportation

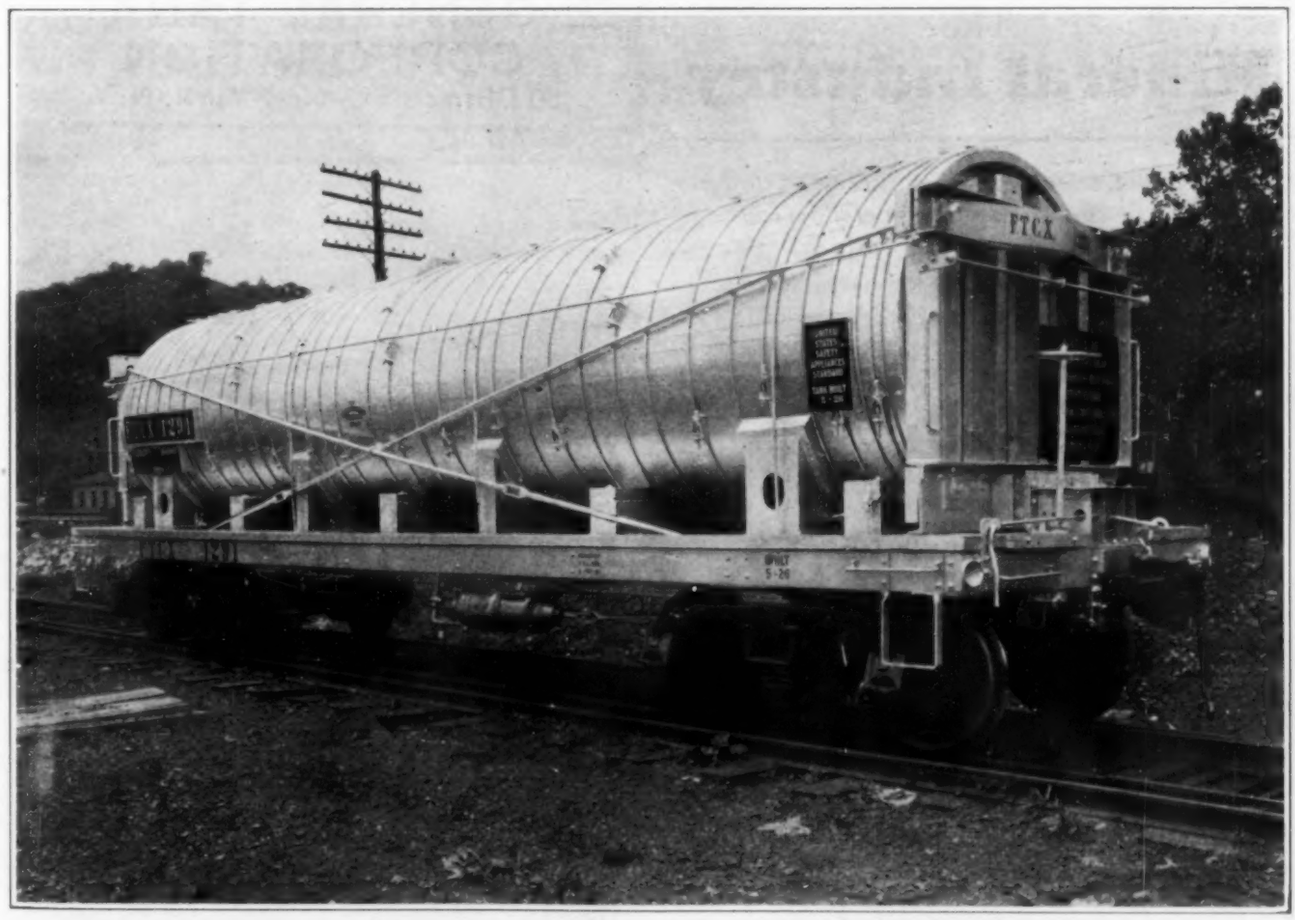
Tank cars of the type shown are a distinct asset in the transportation of chemical liquids of various kinds that can best be handled in wood tank cars. In many cases it prevents contamination of the product and eliminates destructive chemical action on the tank itself.

Built of wood—selected for the specific purpose—designed for a particular service and constructed in a plant with every facility for building high grade tanks—Hauser-Stander offers a complete, modern wood tank car service either plain or lined depending upon liquid to be handled.

The tank car illustrated is made of 3-inch fir staves and 4-inch heads for the Fleischman Transportation Co.

Besides cars, we build wood tanks for storage and process purposes in types and sizes to meet your conditions, if necessary with linings of rubber—special metals—or wood.

If you want modern wood tanks, consult Hauser-Stander. Catalog?

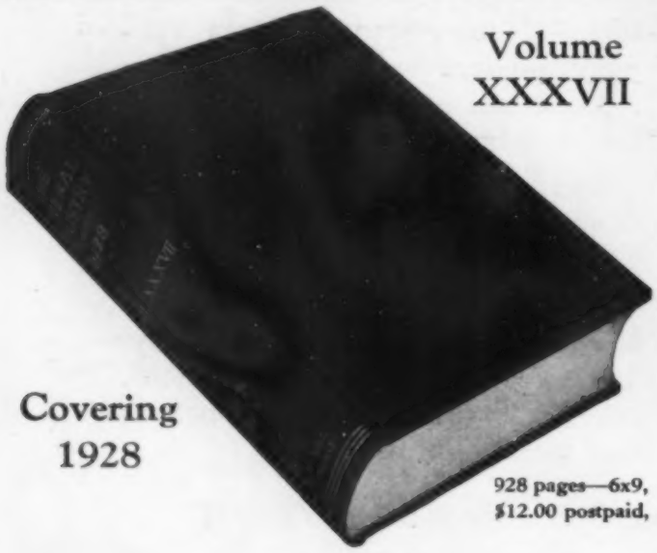


The Hauser-Stander Tank Co.

CINCINNATI, OHIO

New!

Latest edition of this international review of the mineral industry



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MINERAL INDUSTRY is an international annual covering the statistics, technology and trade of the mineral industry throughout the world.

It discusses in individual chapters, alphabetically arranged, sources of supply, statistics of production and consumption, exports and imports, and uses of all commercially important minerals.

These chapters are the work of specialists of recognized standing in each particular industry.

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Round, Rectangular, Oval and Special Shapes for Chemicals, pickling, plating, etc.

Built of
Cypress, Fir, cedar, redwood, pine, maple, etc. Lined, unlined or coated as specified.
Ample Stocks of High Grade Lumber Always on Hand

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Your inquiry will bring immediate reply.

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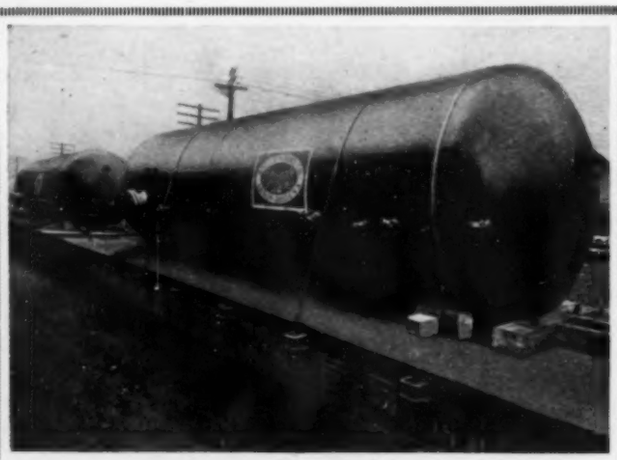


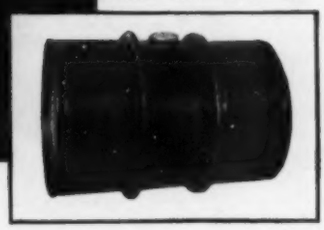
Two all-welded high pressure tanks with welded connections, ready for shipment. 7′ diameter, 36′ long, 1″ plate. Test, 350 pounds. Weight, 46,000 pounds.

Write for This New Folder

The two Welded Tanks pictured above represent one of the many new jobs and types of equipment shown in "Unusual Steel Plate Construction," a Biggs folder recently off the press. May we send you a copy?

The Biggs Boiler Works Co.
1020 Bank Street, Akron, Ohio
NEW YORK CHICAGO DETROIT

Above—a view of the Goodrich Vulcalock Products Department where Acidseal and Armorite linings are applied to acid tank cars, stationary storage and pressure tanks and special tanks, pipe, fittings, and other equipment of all types for corrosive and abrasive service.



Goodrich Vulcalock acid drum. Entire inner surface lined by Goodrich Vulcalock Process. See article below.

Shipments classed *"dangerous"* made safe by this exclusive process

The Vulcalock Process effects permanent bond between acid-resisting rubber and steel, in acid drums transporting "dangerous" corrosives.

. . .

THE danger of leakage and spilling in shipment of hydrochloric acid, hydrochloric acid mixtures and many other materials classed as "dangerous" by the Interstate Commerce Commission, are removed as a result of the Goodrich Vulcalock Process.

This remarkable process developed by Goodrich chemical engineers, effects a *permanent bond* between rubber and metal surfaces—a bond as strong as the rubber itself. The Goodrich Vulcalock acid drum, made of steel and lined with Acidseal (acid-resisting) rubber, takes the danger of breakage and loss of contents, as well as high maintenance and repair costs, out of shipping chemicals.

Because it has been designed to meet every requirement of the Interstate Commerce Commission (specification I.C.C.5-D), this Goodrich Vulcalock acid drum lowers freight rates.

The Vulcalock Process has solved many problems in the distribution and transportation of chemicals. Pipes and fittings can now be successfully lined with Acidseal rubber, as well as tank cars and storage and pressure tanks.

Executives interested are invited to write for additional information. Write to The B. F. Goodrich Rubber Co., Est. 1870, Akron, O., (In the West, Pacific Goodrich Rubber Co., Los Angeles, Cal.) or fill in the coupon below.

Rubber-lined pipe and fittings

Pipe and fittings lined with Acidseal rubber by the Vulcalock Process. Also standard elbows, tees, Y's, crosses of flanged construction.

Rubber-lined, relinable valves

For assembly with steel pipe and fittings; rubber lined by the Vulcalock Process. Always tight. Require no packing. Easily and inexpensively relined.

Fumex transmission belting

Remarkable resistance to acid and other fumes. Fumex belts have outlasted ordinary belts in chemical service by 5 to 1. Send for details.

Goodrich

The B. F. Goodrich Rubber Co. CM-12
Akron, Ohio.

Gentlemen: Please send, without obligation to me, further information on the Vulcalock Process.

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Patents Pending

YOUR 1930 sales plans may well include some thought regarding safe and attractive packaging -- so important in modern selling. The NILES "Ringseal" protects any product in its important journey from manufacturer to final consumer. Let us send you a sample for convincing test and demonstration. ***Sizes to meet every need!***

Your attractive label can be reproduced in striking colors. Sizes in 2½ to 60 gallon capacity -- with full head or recessed head opening. Can be furnished to comply with I. C. C. Specifications.

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Wood Tanks do not rust—do not taint solutions.

Photo shows large wooden tanks installed in a galvanizing plant.

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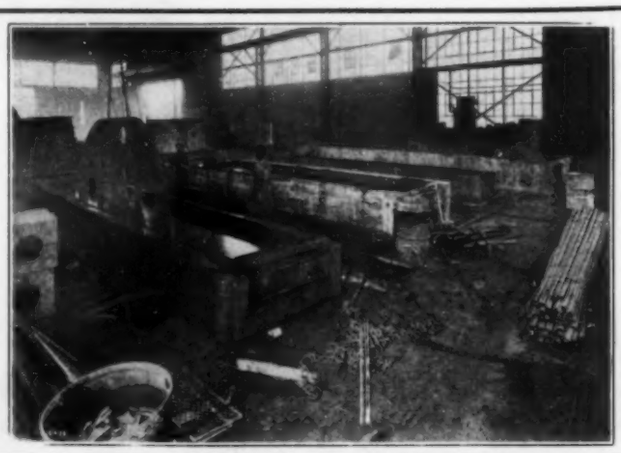
Darby, Pennsylvania



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INTEGRALLY FORGED—

Steel forged pressure vessels made by Midvale have stamina .... they stand the gaff of the hardest usage ... they outwear just ordinary pressure cylinders. Integrally forged—no seams, welds or rivets ... that is the reason for the remarkable service life of a Midvale forging.

Solid walls, solid ends...solid, for it is made in one piece from a single open hearth steel ingot.

A section of a cracking still weighing 87,600 pounds is shown —it is 45 feet in length with a 54 inch diameter. Built from uniform and homogeneous material, this pressure vessel assures long life with utmost safety.

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Agitator Drives — by specialists

with long experience in the agitator problems of all process industries.

They are built in standardized units—complete in every detail—ready to put to work.

Modernized design and durable, rugged construction make them the choice of all users.

There's an interesting series of bulletins being prepared, entitled "Agitation" make certain that you will receive them.

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Address.....

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For Industrial Plants

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Also agitators for all purposes.

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Established 1853

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Cole Pressure Creosoting Cylinder

TANKS & VATS	BOILERS—HRT
for ACID STORAGE	and MANNING
NH₃ STORAGE,	JACKETED KETTLES
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Metal Plate Work

R. D. COLE MANUFACTURING CO.
Established 1854
NEWNAN, GA.
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There are now

4 *Vulcan Kilns at Great Western Sugar Company*

Starting with an initial order for Vulcan Kilns in 1927, The Great Western Sugar Company of Denver, Colorado now has four—a convincing proof of satisfaction in service.

Where a Vulcan Rotary Kiln is at all applicable, it usually represents a tremendous improvement over hand methods or old type machines for the same purpose.

Operating costs are decreased—less labor is required—and a better quality of product is obtained.

These facts have been proved by the records of Vulcan Kilns in service in a hundred different processes and in a score of industries.

It will pay you to check up on the possibilities of Vulcan Kilns for your own process. *Write.*

VULCAN of WILKES-BARRE KILNS

Carbondale Refrigeration

for Chemical Industries—

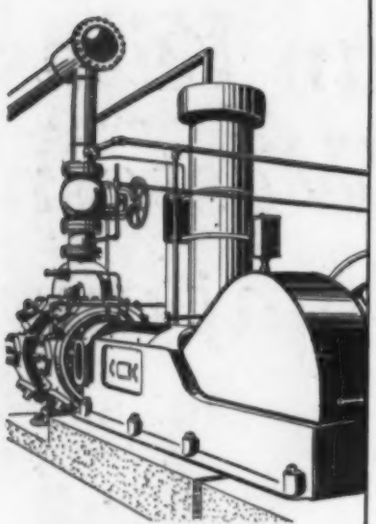
Refrigeration of pre-proved performance ...unlimited in capacity range and temperature

Throughout industry Carbondale Refrigeration is serving with that economy and dependability which is typical of a time-tested, performance-proved product.

Results are never questioned when Carbondale is specified. Whether it be a few tons or a thousand tons of refrigeration, no matter how low the desired temperature may be, Carbondale Absorption and Compression Refrigerating Systems will fill the need precisely.

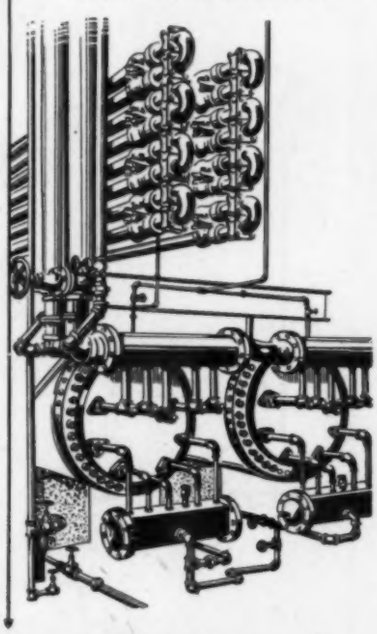
A roll call of every branch of industry that uses refrigeration will find Carbondale well represented. Many installations are still rendering highly satisfactory service after more than 20 years of practically continuous operation.

Call in a Carbondale Engineer. His services are freely offered in assisting you to obtain the exact type of Carbondale Refrigeration for your needs.



A 700-ton—two-stage Worthington "Feather Valve" (Reg. U. S. Pat. Off.) Compressor: "Feather Valve" compressors are used exclusively in Carbondale Compression Refrigerating Systems.

A Carbondale Absorption Refrigerating System showing generators with exchanger and rectifier mounted directly above.



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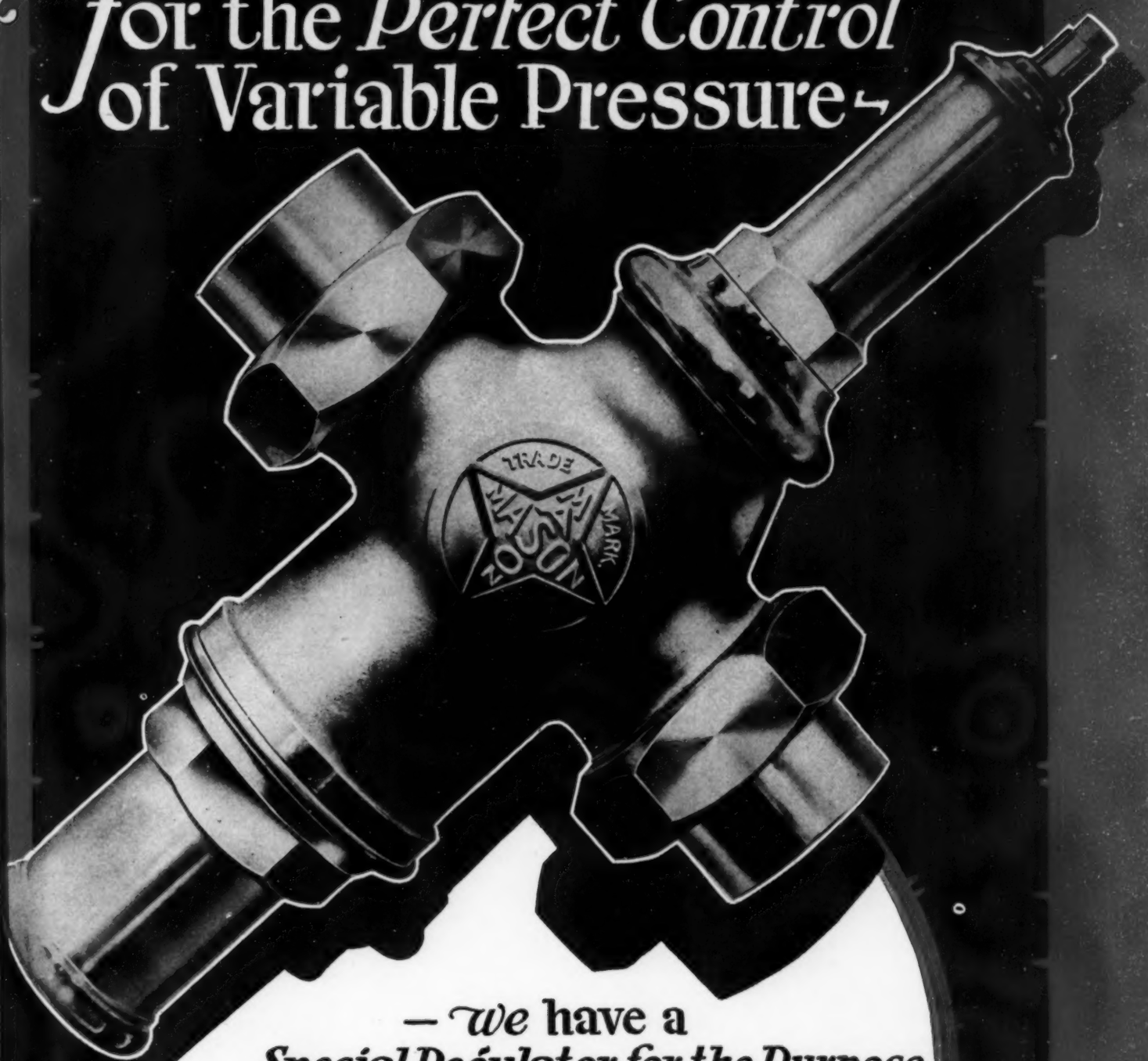
ABSORPTION AND COMPRESSION SYSTEMS

For the *Perfect Control* of Variable Pressure—



—*We* have a *Special Regulator for the Purpose*

no matter whether it be steam, air, oil, gas, or water pressure. They hold the reduced pressures at the desired stage, even after long, steady use, with an undiminishing accuracy and freeness from trouble that will be a revelation to you.

Catalog No. 62 lists a regulator for every purpose—write for it.

MASON REGULATOR CO.,
1190 Adams St.,
Dorchester Centre Station,
BOSTON, MASS.

TRADE MASON MARK

Mason Regulators

See a few of our many types on the next page →

®

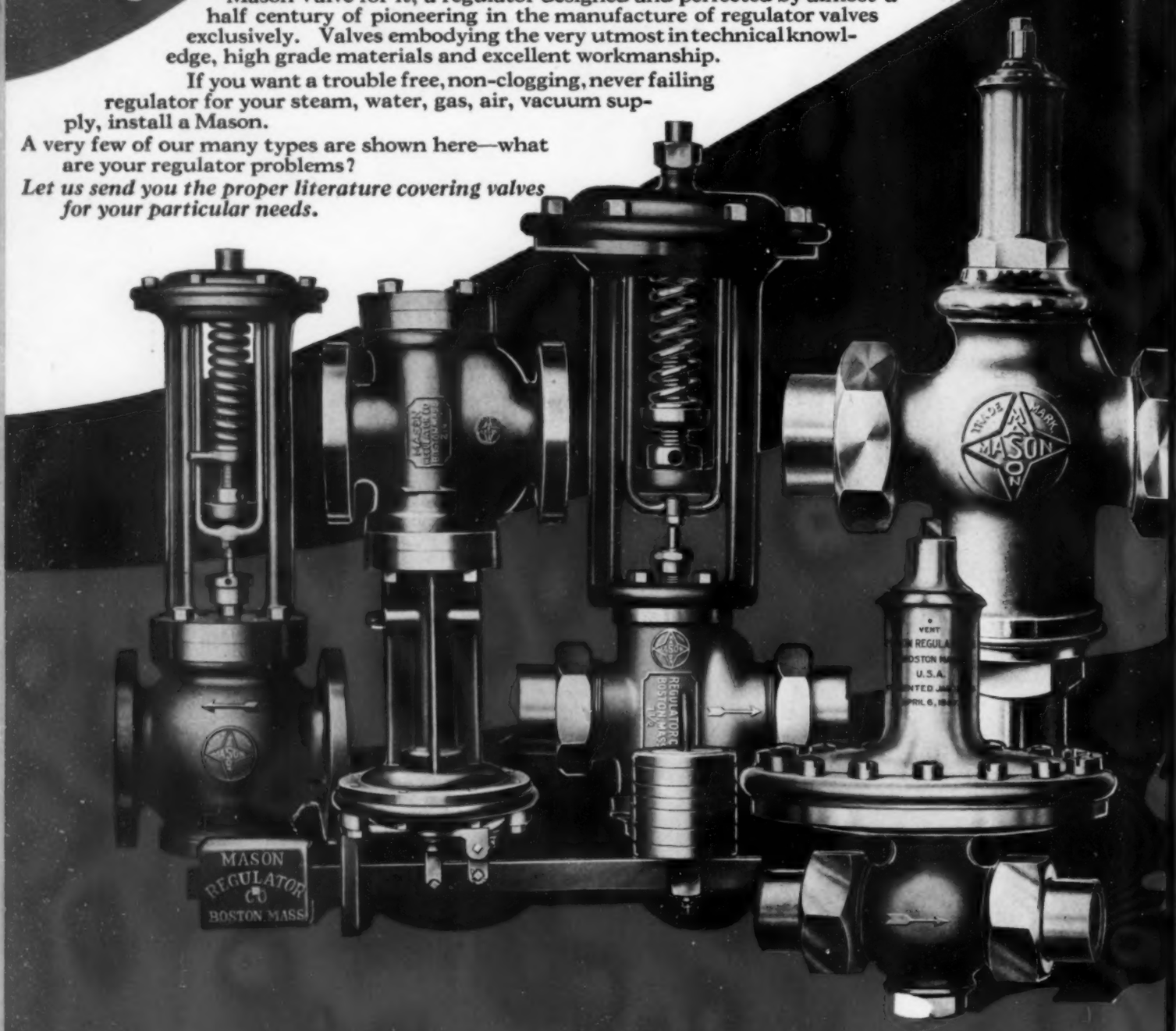
Mechanical Masterpieces All!

Whatever your regulator problems there is a specially designed Mason Valve for it, a regulator designed and perfected by almost a half century of pioneering in the manufacture of regulator valves exclusively. Valves embodying the very utmost in technical knowledge, high grade materials and excellent workmanship.

If you want a trouble free, non-clogging, never failing regulator for your steam, water, gas, air, vacuum supply, install a Mason.

A very few of our many types are shown here—what are your regulator problems?

Let us send you the proper literature covering valves for your particular needs.



Permit Our Engineering Department to Assist You in Planning and Laying Out Your Equipment—and Suggest the Proper Type of Valve for Your Particular Demands.

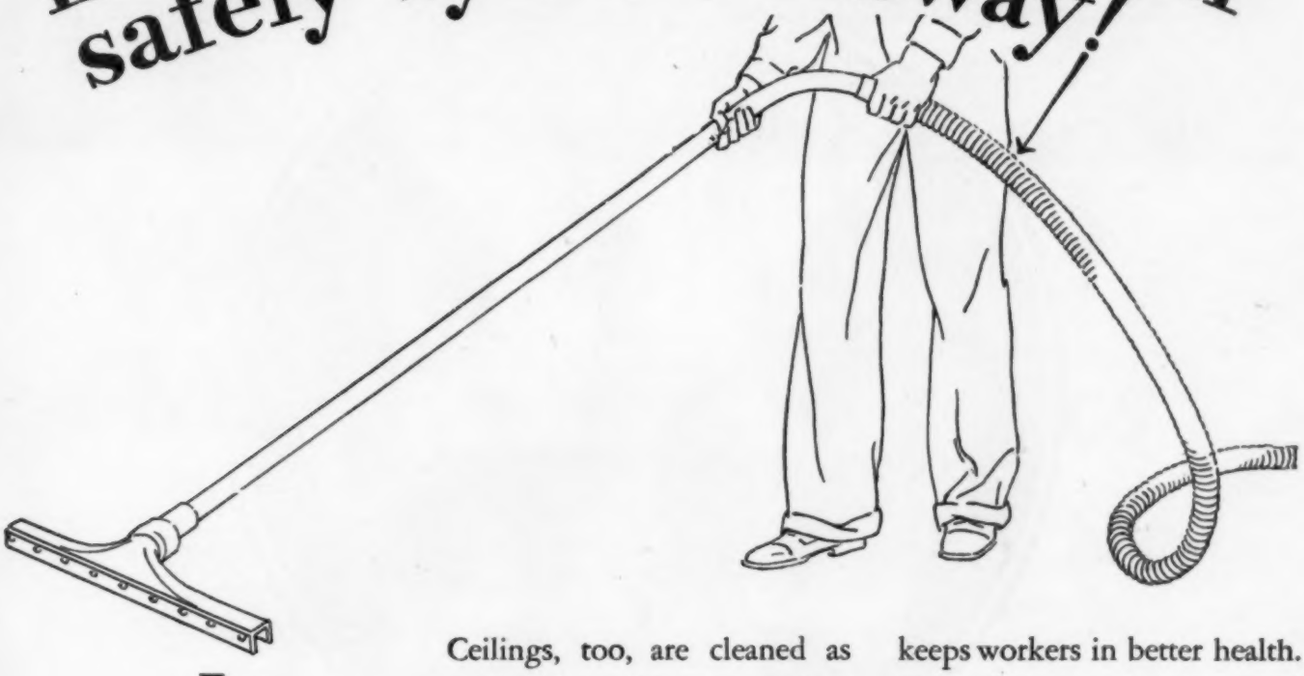
TRADE MARK MASON

Mason Regulators

MASON REGULATOR CO

1190 ADAMS ST.,
DORCHESTER CENTRE STATION
Boston, Mass.

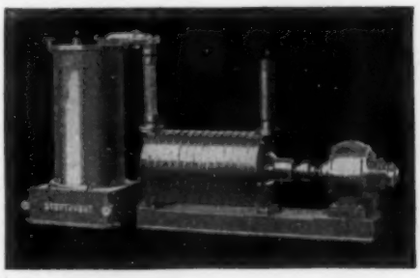
Heavy dirt....light dust..nails and nickels..all travel safely by this subway!



LIGHT trash ...filings...scraps that commonly have to be swept up or picked up are whisked right out of the plant, via the Sturtevant "tubes". The powerful suction pulls all sorts of odd freight at express train speed, down into the dust-collector.

Sturtevant Vacuum Cleaners reach every place in the plant ...corners and awkward places, ledges, duct work and piping. Ceilings, too, are cleaned as easily as floors. No other method of cleaning can make such a thorough clean sweep.

Sturtevant Vacuum Cleaning has a wide-spread effect...keeps machines and equipment in better working condition ... keeps workers in better health. Depreciation and fire hazard are put under control.

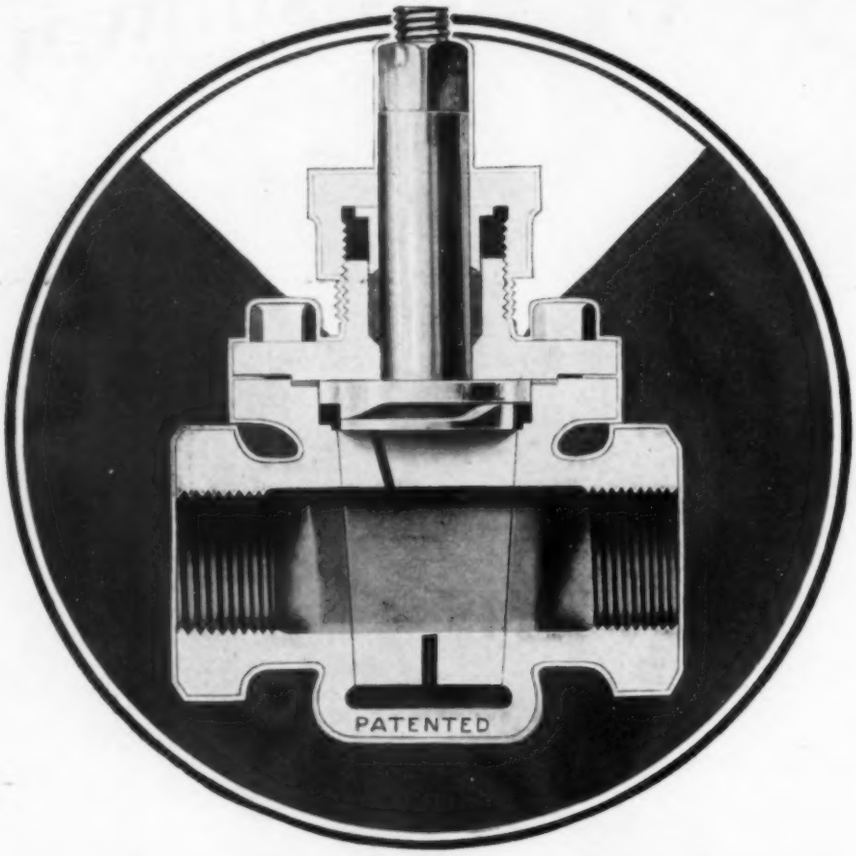


There are Sturtevant Vacuum Cleaners both Stationary and Portable, both Light and Heavy Duty. Our nearest office will gladly give you all the details on the system best suited to your plant.

B. F. STURTEVANT COMPANY
Hyde Park, Boston, Mass.
Branch Offices in Principal Cities:
Canadian Offices at: Toronto, Montreal and Galt. *Canadian Representative*: Kipp Kelly Ltd., Winnipeg — Also Agents in Principal Foreign Countries

Sturtevant REG. U.S. PAT. OFF.
Vacuum *Portable and Stationary* **Cleaners**

Stop the Leaks In Your Process With Quarter-Turns



HOMESTEAD

Leaking valves are not only a menace to a process but represent small losses daily which accumulate and form staggering figures over a year's time.

Homestead Quarter-Turns are designed and constructed to eliminate these costly losses.

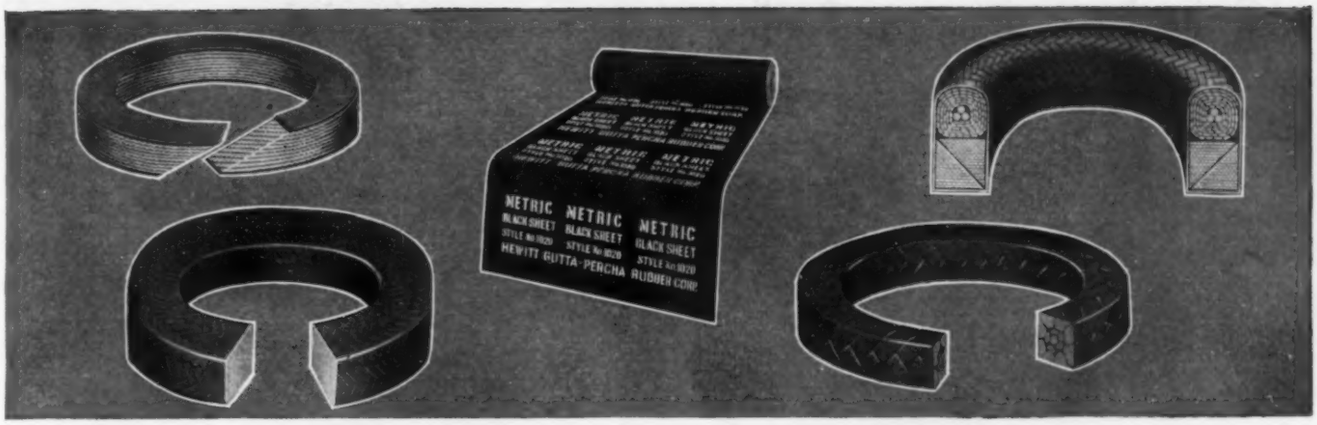
The bottom of the valve is sealed—the bonnet is sealed with a gasket—the seating parts are protected from grit while open and cam seats valve perfectly when closed—from a construction standpoint, this Quarter-Turn offers a quick acting, positive, drop-tight valve.

No matter what the process, this Homestead has possibilities which adapt it to a host of uses. Thousands are now giving users care-free service on water lines—air lines—pulp lines and many other kinds of applications.

What are yours? Catalog Number 35 will be sent at your suggestion.

Homestead Valve Manufacturing Co.

P. O. Box "H" Coraopolis, Penna.



Why not
"MEASURE of MERIT" PACKINGS

Why not attack operating expense from the packing angle? Why not experience the phenomenal service of Metric packings that not only measure up to the rigid requirements of U. S. Government specifications but set the pace for competition?

IN YOUR PLANT the Metric line of packings manufactured by Hewitt-Gutta Percha will answer every need with an inevitable saving. There are styles and types of Metric packings for every use. Let our specialists make recommendations and the benefits of quality plus specific application are yours. Cost cutting value is the "Measure of Merit" in Metric packings.

Write for new catalog.

HEWITT-GUTTA PERCHA
RUBBER CORPORATION
BUFFALO, N. Y.

METRIC
Rod and Sheet Packings

This booklet is for every industrial executive

Your copy now ready—send for it today!

Interesting, factful

The pumping problems in your plant may be few or many. They may be difficult or simple. Yet, this little booklet, "The Secret of Hydraulic Balance" will be vastly interesting to you. And it is likely that you can derive some very specific benefits from it. The various principles of pump construction are outlined with a discussion of each, bearing on the subject of "What does Industry want, need and expect from the pumping units that it purchases?"

Blackmer, in preparing this booklet, has had full benefit of a broad background of experience in solving every kind of pumping problem. Thus this booklet has interest, authenticity and real helpfulness.

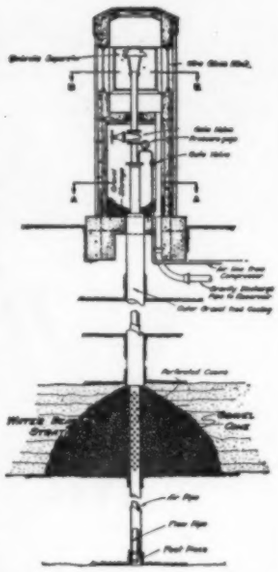
We'll be mighty glad to send a copy to you, without obligation.

BLACKMER PUMP CO.
1808 Century Avenue
Grand Rapids, Michigan

Can the Gallons-per-Minute be Maintained?

Scores of cities now say "Yes, with Sullivan Air Lift"

When your wells slow up—there is usually plenty of water available. But sand has packed around the screen and reduced the inflow—or it has worn the mechanical pumps so they do not carry a full load of water. Both of these difficulties are overcome by the Sullivan Air Lift System and "Air Made" Wells. Sand is removed from the well and replaced by coarse gravel. And there are no moving parts in the well to be damaged by sand. Scores of these wells have been installed where other wells went dry. And in every instance the Sullivan Well maintained or increased its production.



At Tonkawa, Oklahoma, ten of these wells doubled in flow in two years, while other wells all around them were abandoned. At Chandler, Oklahoma, one "Air Made" Well produced more water than forty mechanical wells previously used. And in many other places Sullivan Air Lift has solved the problem of wells slowing up.

Sullivan Air Lift will give you "dependable water supply anywhere." Why not send for Catalogs 71-I, and 56-J?

Sullivan Machinery Company
724 Wrigley Bldg., Chicago

TABER PUMPS

For

CHEMICAL SOLUTIONS

Ever-growing exacting requirements demand pumps superior to those acceptable in the past.

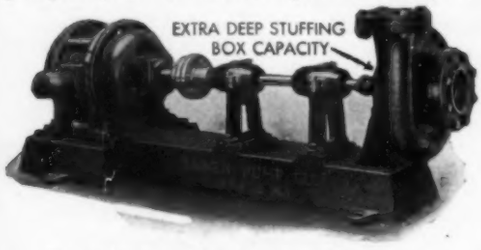
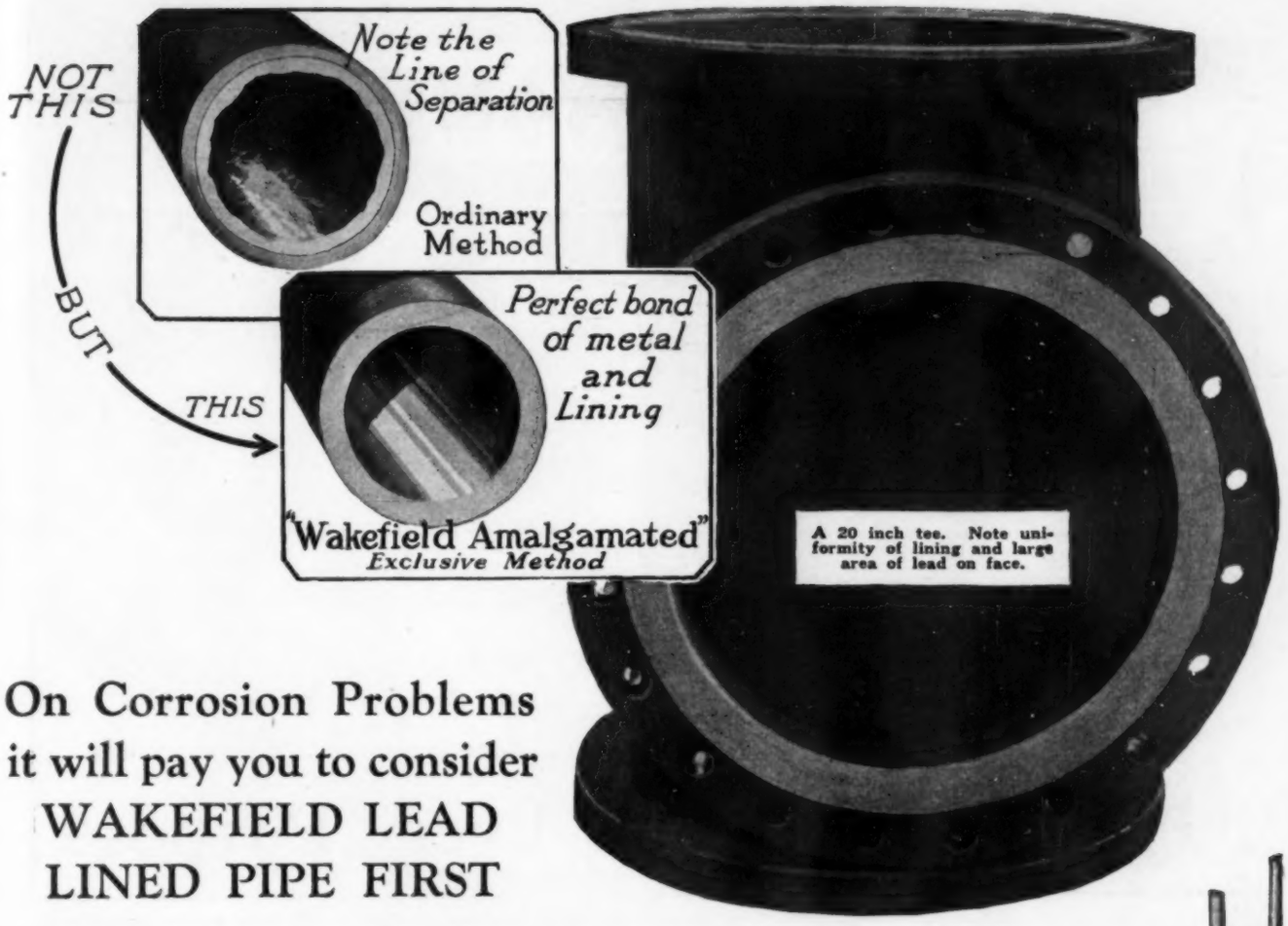


Fig. 603F Taber Standard Centrifugal Pump.

For Industries where the transfer of caustic solutions necessitates special alloy pump construction, Taber builds them of nickel. . . . monel . . . or chrome nickel alloys. And Taber standard centrifugal pumps of iron, semi-steel or bronze are most economical for pumping all kinds of chemical solutions. Where viscous materials must be handled, Taber Rotary Pumps are recommended.

Send for Taber Data Sheet and submit your pumping problem to pump engineers. No obligation for our recommendation.

TABER PUMP Co.
294 Elm Street, Buffalo, N. Y.


NOT THIS
Note the Line of Separation
Ordinary Method
BUT
THIS
Perfect bond of metal and Lining
"Wakefield Amalgamated"
Exclusive Method
A 20 inch tee. Note uniformity of lining and large area of lead on face.

On Corrosion Problems it will pay you to consider WAKEFIELD LEAD LINED PIPE FIRST

When the problem of handling alkalies, hot water, sodium bisulphate or any other corrosive material arises, you will save time and money if you consider Amalgamated Lead-Lined iron pipe FIRST instead of later when other metals have failed or have proved too costly.

"Wakefield Amalgamated" lead-lined pipe is *permanent*—made by the *thorough* amalgamation of a heavy, pure chemical lead lining with a ruggedly strong iron shell. The thick, smooth lead lining cannot be separated or torn away by bending, cutting or rough usage.

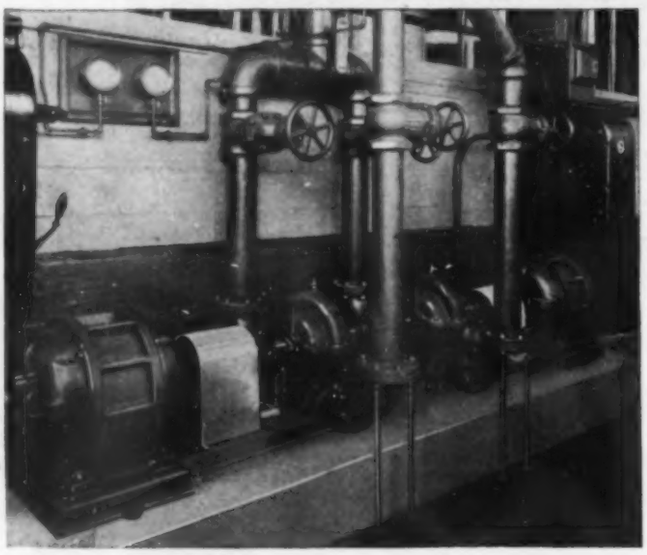
Call on The Pioneers of the Lead-Lined industry FIRST for advice when you need Lead-Lined Iron Pipe, Fittings and Valves. Our thirty-five years' experience proves that you will save money FIRST and LAST.

½ inch lead covering on this coil used for heating a bath of acid. What is *your* problem?

LEAD-LINED IRON PIPE COMPANY
Wakefield, Mass.
Pioneers and Leading Manufacturers of Lead Lined Equipment

"WAKEFIELD AMALGAMATED" lead-lined products

PERFORMANCE!



Performance is the sum of operating characteristics over a period of time. It is gratifying to receive repeat orders from plants where Buffalo Pumps have been used for years. It means that Buffalo Pump Performance is satisfactory in every respect.

Judge your pumps on performance. Our complete line will stand any inspection. And years of service will tell you their sterling performance.

Bring your pumping problems to us—we will gladly help you solve them.

Buffalo Steam Pump Co.
501 Broadway, Buffalo, N. Y.
In Canada:
Canadian Blower & Forge Co. Ltd., Kitchener, Ontario

"Buffalo" PUMPS for Every Purpose

WESTON CENTRIFUGALS

Original (1866)
Reliable
Economical

For All
Chemicals Requiring
Centrifugal Process

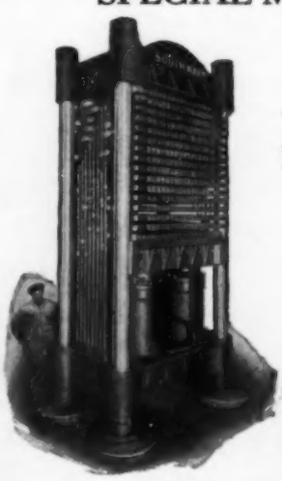
Automatic Sprayers for Washing Contents

Sizes 20-inch to 40-inch.
Materials of construction adapted to product

Established 1843
AMERICAN TOOL & MACHINE COMPANY
Trade Mark Registered U. S. Patent Office
BOSTON

SOUTHWARK

HYDRAULIC PRESSES
Types to suit every operation
SPECIAL MACHINERY



Hydraulic Pumps, Accumulators, Valves, Fittings etc., Hydraulic Presses for every purpose.

Special machinery designed and built to suit requirements.

The illustration at the left shows a four-cylinder steam platen press of 800 tons capacity. Used for moulding and curing rubber, bakelite, fibre, shellac compositions and other plastics.

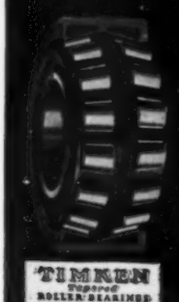
ESTABLISHED
1836
SOUTHWARK
FOUNDRY AND MACHINE CO.
400 Washington Avenue
Philadelphia, Pa.

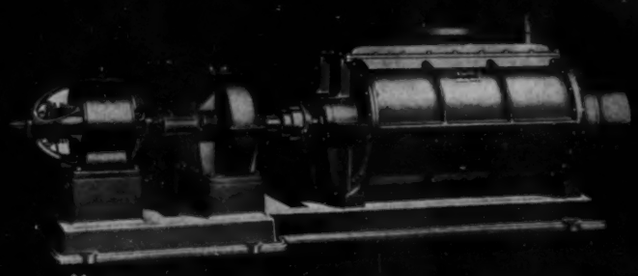
MACHINERY EXPOSITION OF 3029 A.D.

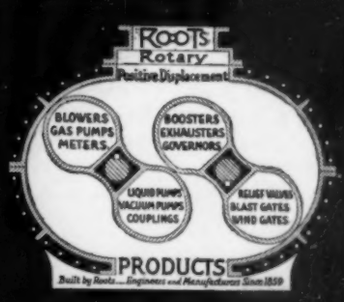
OBSOLETE DIVISION Nº RS-3-PUMPS

ROOTS PUMPS WON'T BE IN A SHOWCASE!

They'll be in service in the exposition hall, furnishing air for ventilating and for pneumatic carrier conveying. Buy a Roots for long service.
NOTICE - PLEASE DO NOT EXCITE YOUR ROBOTS NEAR THESE CASES -
SNAIL BLOWER VERY RARE 1929
WHIZZO BLOWER GENUINE 20TH CENTURY MODEL







"Roots Users Root for Roots"

The P.H. & F.M. ROOTS CO.

CHICAGO
Peoples Gas Building

CONNERSVILLE, INDIANA

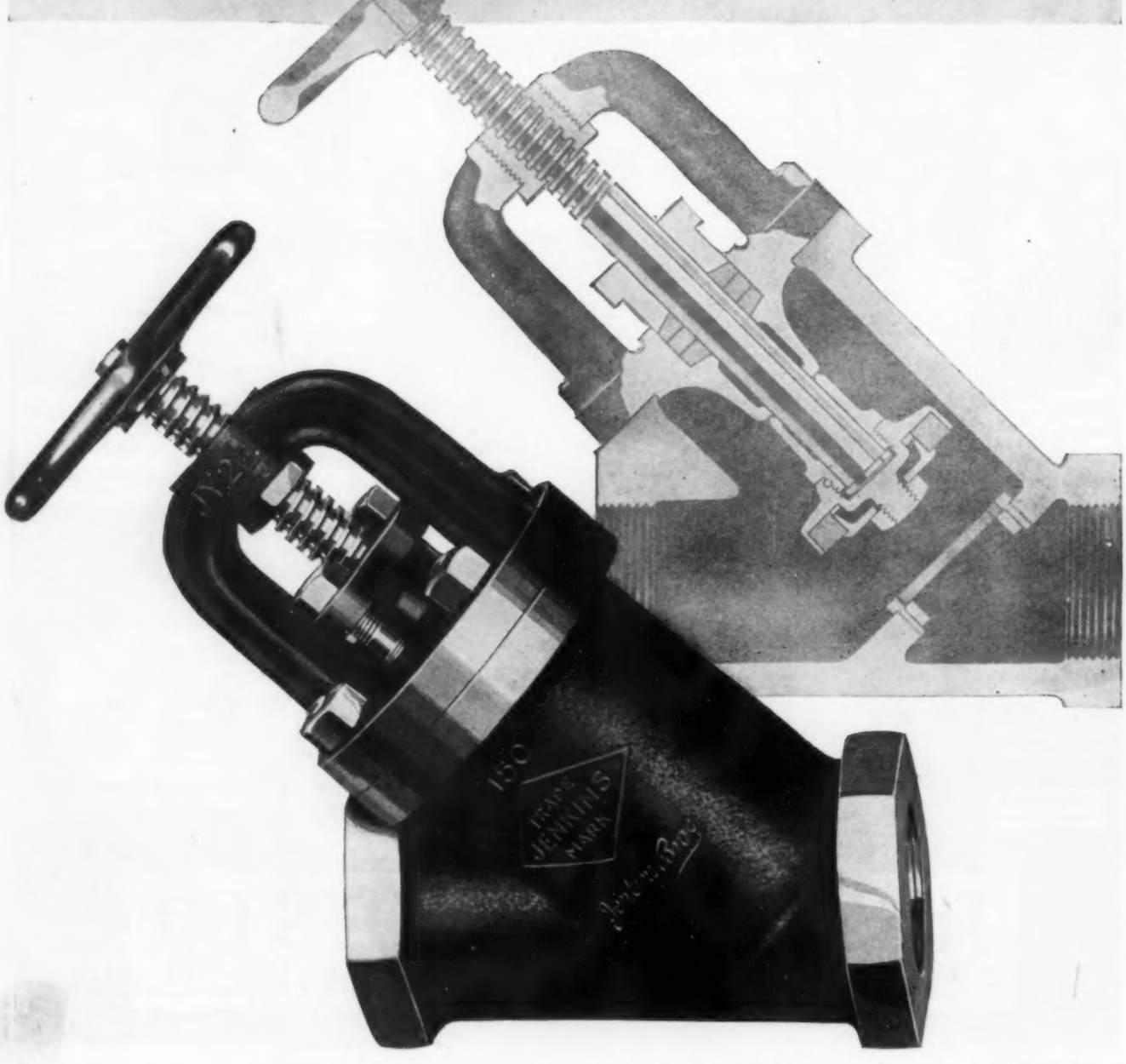
NEW YORK
120 Liberty Street

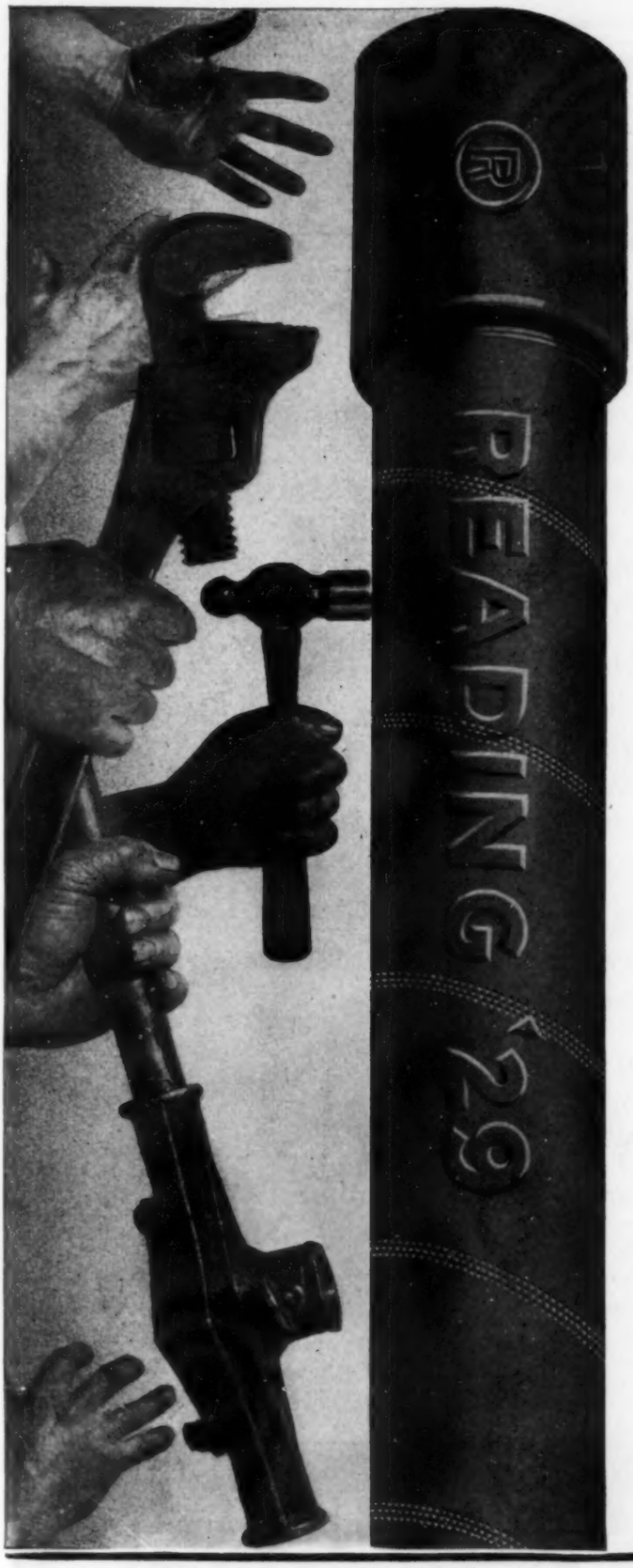
Jenkins VALVES ARE ALWAYS MARKED WITH THE "DIAMOND" TRADE JENKINS MARK

Jenkins Bros

Threads are strong and clean cut

IN Jenkins Iron Body Valves, precision machined threads hold spindle in perfect alignment. Pipe end threads, clean cut and accurate, make tight joints and installation easy. This Fig. 296, Jenkins Standard Iron Body "Y" Valve, for 150 pounds steam or 250 pounds water, provides a flow practically in line with the pipe, and the additional advantages of a Jenkins Renewable Disc and Renewable Seat Ring. Jenkins Bros., New York, Boston, Philadelphia, Chicago. Jenkins Bros., Limited, Montreal, London.





Hands—Hands—Hands—5-Point Pipe Keeps Them From Costing You Money!

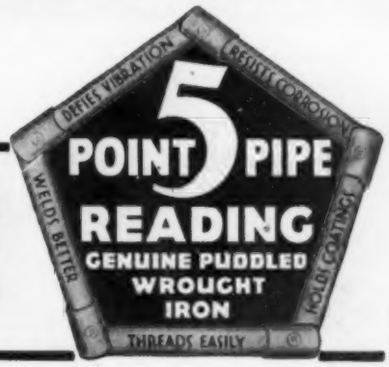
The life of inferior pipe is just a succession of "hands"—"hands" that tinker with it—"hands" that repair it—"hands" that replace it! Reading 5-Point Pipe keeps these costly hands away because it's the kind of pipe that "stays put"—from three to five times longer!

Only superior pipe material gives service like this. The secret of 5-Point Pipe endurance is Genuine Puddled Wrought Iron, produced by forcefully working together pure pig iron and rust-defying silicious slag inside a flame-filled furnace and double welded for extra strength. This is the time-tested way of assuring complete pipe dependability. You'll find that Reading 5-Point Pipe is truly moderate in price—insist on getting it.

READING IRON COMPANY
Reading, Pennsylvania

Atlanta · Baltimore · Cleveland · New York
Philadelphia · Boston · Cincinnati · St. Louis
Chicago · New Orleans · Buffalo · Houston
Tulsa · Seattle · San Francisco · Detroit
Pittsburgh · Ft. Worth · Los Angeles · Kansas City

GENUINE PUDDLED WROUGHT IRON
READING PIPE
DIAMETERS RANGING FROM 1/8 TO 20 INCHES



. . . . What would your Banker think of a 43% YIELD per year?

At the present time, when most gilt-edge securities yield around 4% at market prices, bankers would doubt the *security* of an investment paying 43%. And yet, you can make an investment right in your own plant, where there is no doubt about its safety, that has paid that rate and even higher.

In the Metropolitan Life Insurance Bldg., Long Island City, General Ceramics Stoneware pays a net return of 43% on the cost. In plant of Chas. Cooper & Co., New York, it pays 42% a year on the investment. In the Pearl White Products Co., Chicago, it has effected a cost reduction of 66.5%.

G-C Stoneware is vitrified all the way through and guaranteed to be tight, non-porous and impregnable by corrosive substances.

Made in designs to meet every requirement for the production, storage and handling of corrosive chemicals.

Write for our catalog, or mail the coupon.

GENERAL CERAMICS CO.

225 Broadway, New York City

276 Monadnock Bldg., San Francisco
208 So. LaSalle St., Chicago
1111 Beaver Hall Hill, Montreal

General Ceramics Co., CME
225 Broadway, New York City

Without obligation on our part, you may

☐ Send a copy of your Catalog.

☐ Have your engineer call.

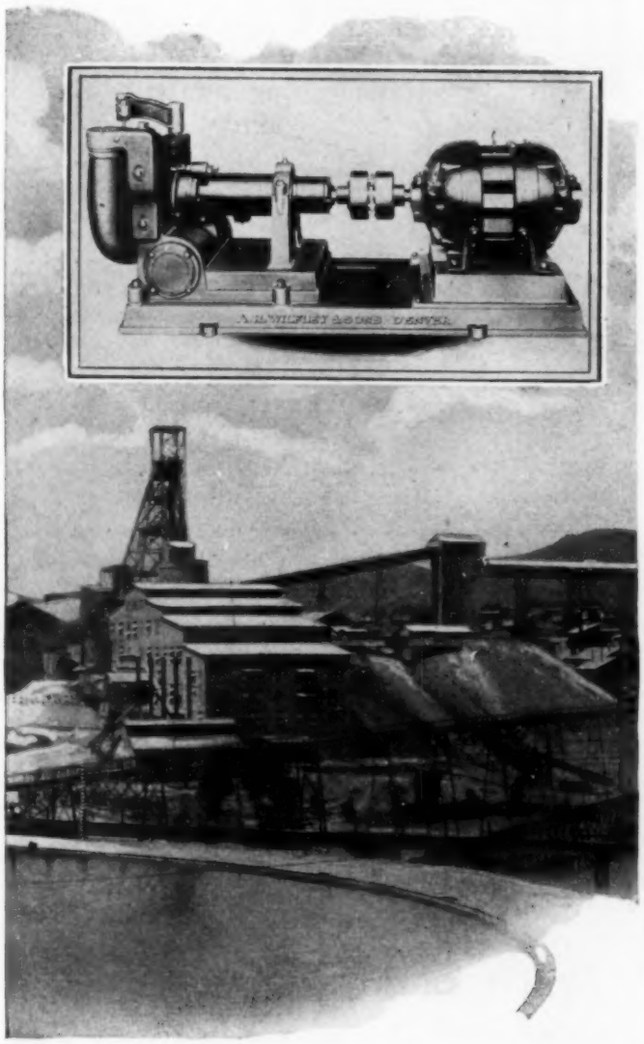
Name .....

Address .....

Town .....State .....

GENERAL CERAMICS
CHEMICAL STONEWARE

The Mining Field Offers a Suggestion on Pumps to the Process Industries



In ore dressing plants in the mining industry, several different classes of pulp mixtures are to be found.

Solid particles are mostly ore or sand, all of a gritty nature. The percentage of solids runs even as high as 75%.

In these plants, so many units of the Wilfley Centrifugal Sand Pump are used that it is considered standard. It has these three features which make it so popular:

no stuffing box
slippage seal adjustment
quick change of wearing parts

These same features make the Wilfley Centrifugal Pump a mighty good investment for those process plants handling pulp mixtures.

We will be glad to offer suitable recommendations for your pumping problem.

A. R. WILFLEY & SONS, INC.
P. O. BOX 2330
DENVER, COLO., U. S. A.

WILFLEY Centrifugal SAND PUMP
PATENTED

Duriron Fitted—Type G

This pump more nearly approaches the solution of the difficulties encountered in feeding acids in any degree of concentration—giving a high measure of immunity from corrosion. Blue prints and particulars on request.

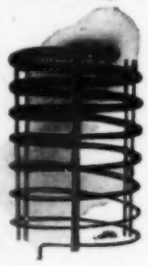
HILLS-McCANNA
CHEMICAL PROPORTIONING
PUMPS

HILLS-McCANNA CO.
2341 NELSON ST. - Chicago
THE MOST COMPLETE SERIES OF ALLOYS FOR INDUSTRIAL USE
FORCE-FEED LUBRICATORS · PROPORTIONING PUMPS · TANK CAR VALVES

Finely Made Coils
of
Seamless Toncan Pipe
Allegheny, Enduro

Super corrosive resisting, and in many respects superior to so-called stainless iron or steel.

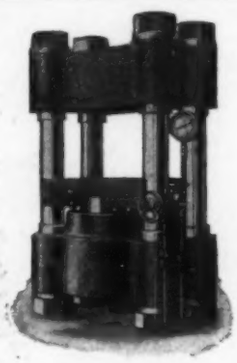
National Coils are widely used and enjoy a high reputation for good service throughout the leading industries of the country. May we quote on your specifications? Write for descriptive bulletin.



We also design and manufacture all types of heat transfer apparatus, storage and feed water heaters.

THE NATIONAL PIPE BENDING CO.
Est. 1883
140 River St., New Haven, Conn.
Boston New York Philadelphia

1000 Ton
Hydraulic
Die Press



HYDRAULIC EQUIPMENT

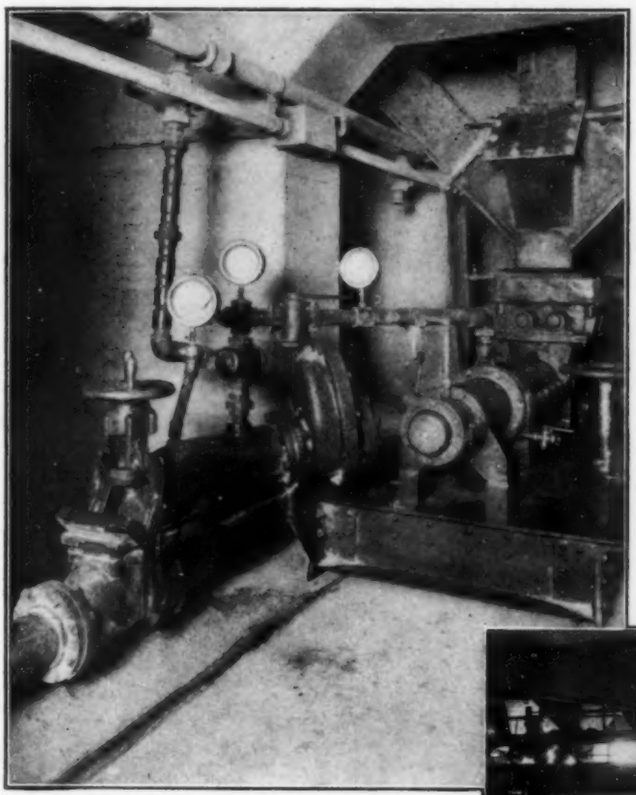
We build complete hydraulic plants including pipe, valves, pumps, accumulators, intensifiers, and presses for every purpose such as:

Forming
Dehydrating
Thermo Plastic Moulding
Blocking and Extruding
Briquetting
Baling
Clay Forming
Sagger Moulding
Moulding and Vulcanizing
Oil Extracting
Cocoa Butter Extracting
Compressing and Forming
Etc.

Write for Catalog

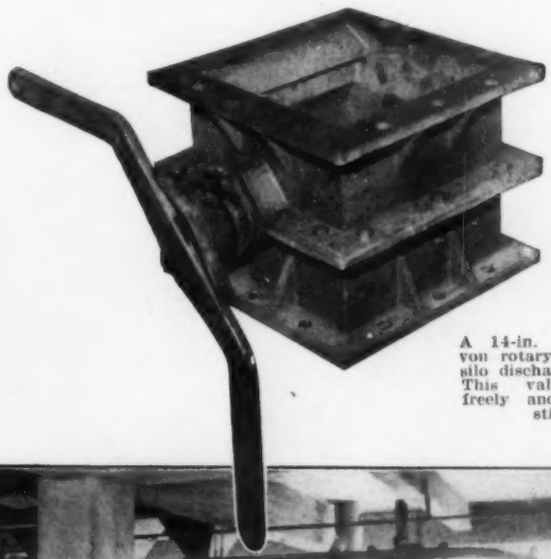
THE WATSON-STILLMAN CO.
NEW YORK, 74 West Street
W-S HYDRAULIC
Chicago — Cleveland — Detroit
Philadelphia — Richmond — St. Louis

Portable Fuller-Kinyon Pumps Speed Up Cement Shipments in Bags or Bulk

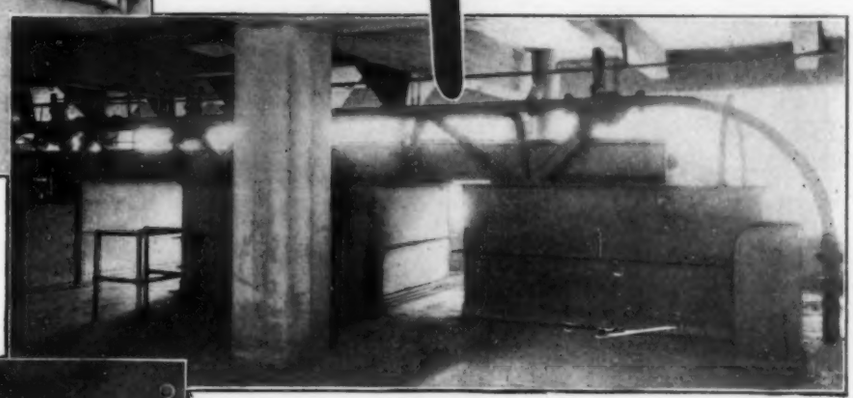


An 8-in. Portable Fuller-Kinyon Pump.

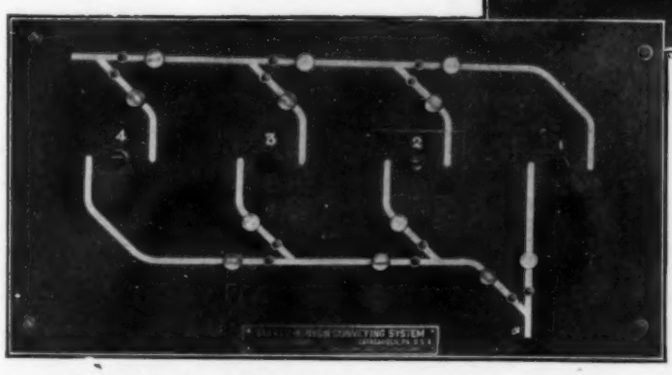
These pumps are included in a Fuller-Kinyon Conveying System for the dustless automatic handling of finished cement.



A 14-in. Fuller-Kinyon rotary valve for silo discharge spouts. This valve moves freely and will not stick.



Paralleled pipe lines of two Fuller-Kinyon Conveying Systems delivering finished cement from silos to four packer bins.



Master control panel and signal system from which one operator can control the operation of the entire system. Note the diagrammatic representation of the paralleled transport lines and their distributing valves.

The Fuller-Kinyon Portable Pumping System includes Fuller-Kinyon pumps, silo discharge spouts, rotary spout valves, transport pipe lines, automatic distributing valves, bin connections and complete automatic and remote control panel from which one operator can control and supervise the operation of the entire system.

This system is used in handling soda ash, bauxite and other dry pulverized materials in several plants.

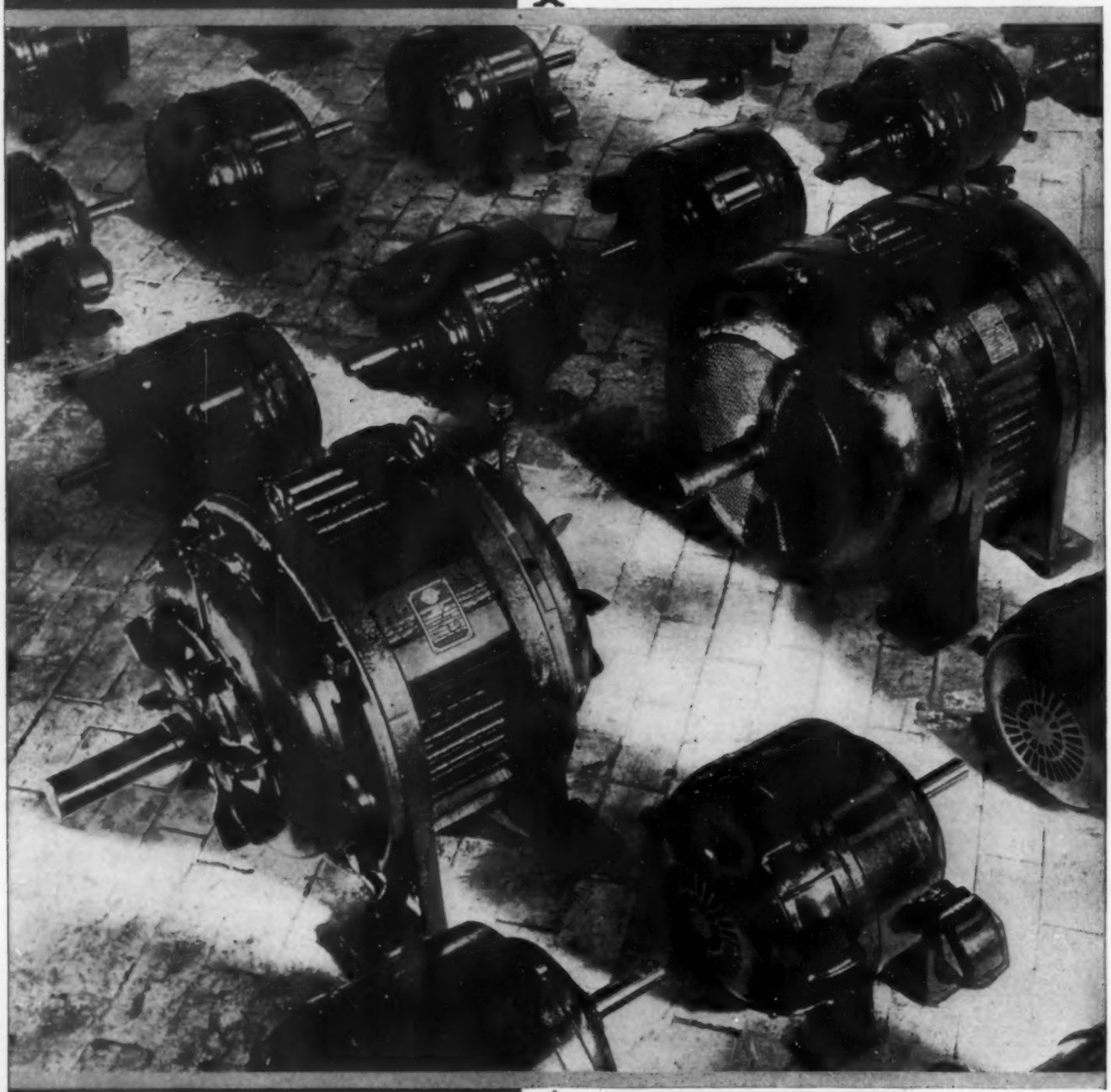
FULLER-KINYON CONVEYING SYSTEM

Fuller Company

CATASAUQUA, PENN. U. S. A.

Clean... Cool

In many applications motors fail due to external conditions such as corrosive fumes, dust or moisture. Wagner makes a complete line of enclosed motors cooled by a fast moving jacket of air produced by an external blower (in small sizes the blower is on one end, in the larger sizes on both). In the illustration the casings are removed from one of the motors to show the position of the two blowers.



Wagner, Quality

Wagner motor advice is unbiased because Wagner makes every commercial type of alternating-current motor.

Literature on Request

WAGNER ELECTRIC CORPORATION

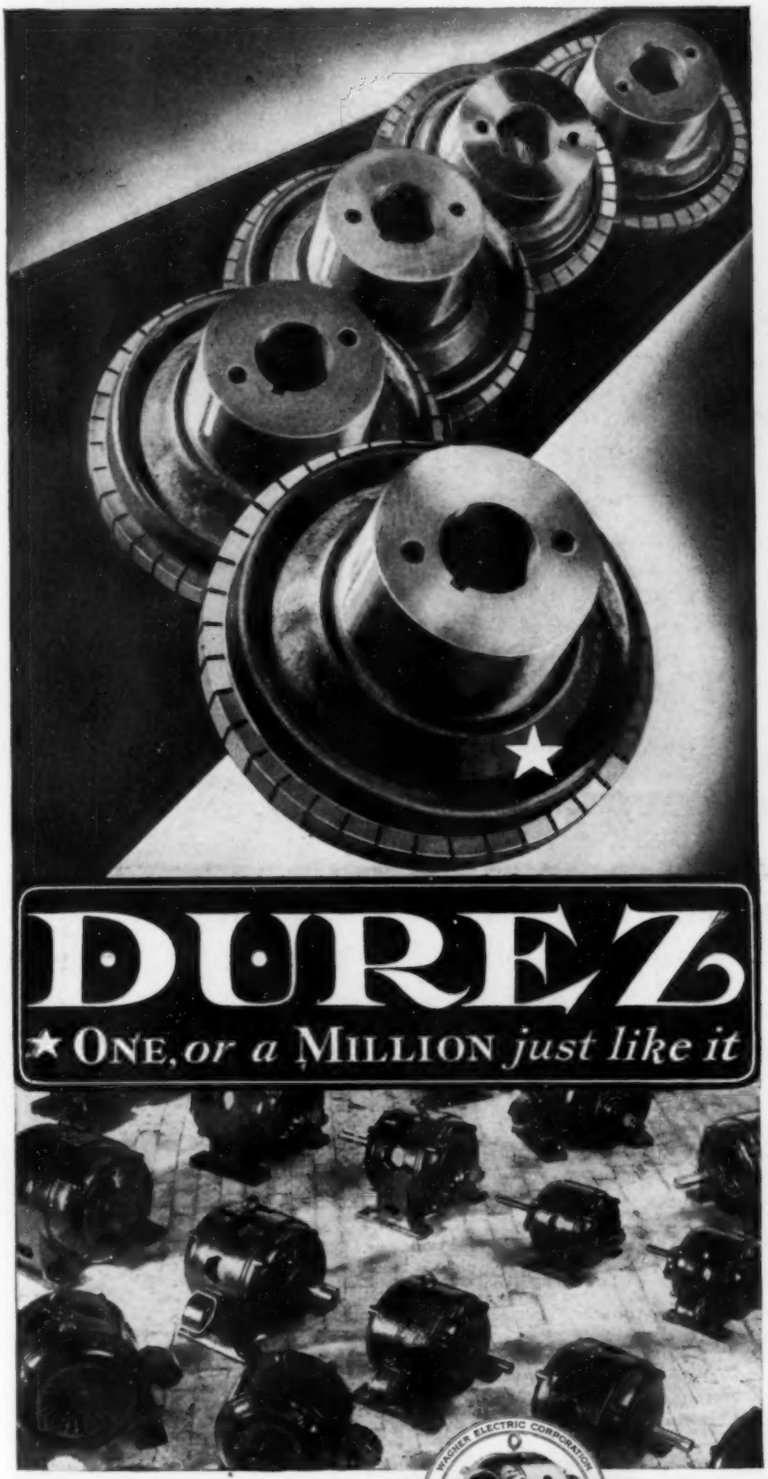
6400 Plymouth Ave., St. Louis

Sales and Service in 25 Principal Cities

PRODUCTS . . . FANS . . . DESK . . . WALL . . . CEILING
TRANSFORMERS . . . POWER . . . DISTRIBUTION . . . INSTRUMENT
MOTORS . . . SINGLE-PHASE . . . POLYPHASE . . . DIRECT CURRENT

61-7632-2

WAGNER uses



An advertisement of the Wagner Electric Corp. will be found on the opposite page.

Wagner Quality

DUREZ!

THE Wagner Electric Corporation makes motors. *Quality* motors. They make fans, too. *Quality* fans. And transformers. *Quality* transformers. A house whose reputation is unquestioned, they demand the best, and they get it. . . . See the commutator on the left? The section with the star? Made of Durez.

Wagner uses Durez because Durez is perfect in dielectric qualities. Its heat-resisting qualities are high. It will not cold flow. It has high tensile and compressive strength. Acids, moisture, alkalines, dirt have no effect upon Durez.

There are other reasons why Wagner uses Durez—many of them. Reasons that should guide *you* in choosing this perfect molding compound. Durez comes from the mold complete—your product made in one operation. Durez is strong, hard, tough. Durez is durable. Durez—efficient, reliable—fills all the requirements of other materials, and has additional virtues of its own!

Consider this: Is your present material the best for the purpose? Is it as economical, as satisfying in the long run, as Durez? Investigate! Learn how easy Durez is to work—how skilfully, accurately, the most intricate designs can be molded. Learn how this remarkable basic formula material can effect production economies and increase the salability of your product by modernizing it. Whether you're using wood, celluloid, fiber, metal, ivory, glass, porcelain, or any other materials, *investigate* Durez!

Durez engineers will gladly co-operate with you. Address General Plastics, Inc., 124 Walck Road, North Tonawanda, N. Y. Also New York, Chicago, San Francisco and Los Angeles.

✡

Write for this free booklet—"Do It With Durez." Contains complete information about Durez—physical and dielectric properties, color ranges, and scores of possible applications.

20 Horse Power Century Type SC
Multi-Speed Constant Torque Squirrel Cage Induction
3 and 2 Phase Motor

MULTISPEED

Constant Torque Motors
Constant Horse Power Motors
Variable Torque Motors

Multiple speeds from a squirrel cage motor, with push button or drum control, offer a solution of many drive problems—among machine tools, woodworking machinery, mixers, blowers, stokers, conveyors, etc.

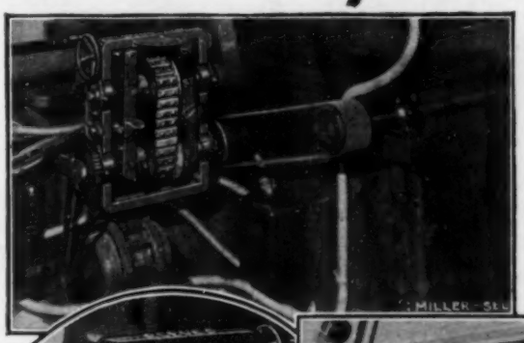
They are built regularly for 2, 3 and 4 speeds, with wide or narrow speed ranges like 1800-1200 or 1800-600 down to 900-450 r. p. m. (60 cycle). Special speed combinations available as described in bulletin 13-1.

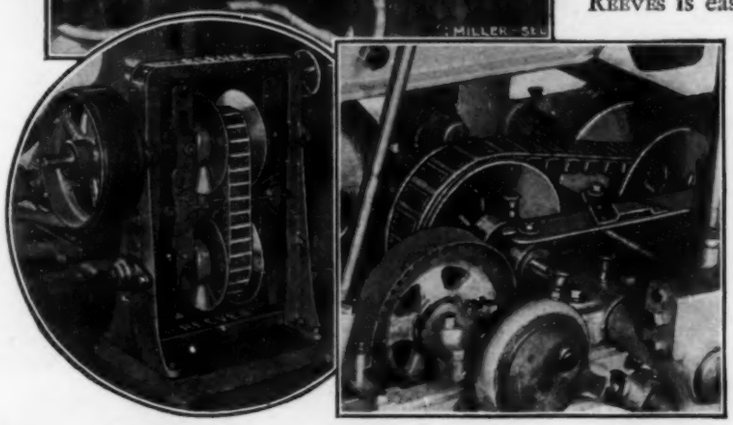
CENTURY ELECTRIC COMPANY
1806 Pine St. St. Louis, Mo.
40 U. S. and Canadian Stock Points and more than 75 outside thereof

Century MOTORS

"THEY KEEP A-RUNNING"

COMPACT
in every installation



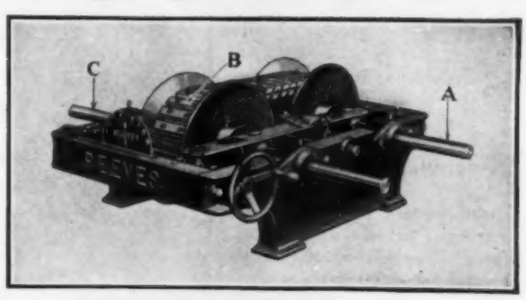


IN its modern design . . . shorter, narrower, more compact . . . the REEVES Transmission requires a minimum amount of floor space. In practically every installation, it can either be incorporated as a part of the machine it regulates, or it can be placed under a projecting part of the machine, mounted on a platform, or suspended from the ceiling. The REEVES is easy to install and takes up very little additional space beyond that already required by the machine it drives.

Above left: Showing the REEVES Transmission compactly mounted right on the frame of a Norton Grinder. *In circle:* Vertical type of REEVES closely installed at the driving end of a Swift Electric Welder. *Lower right:* Internal parts of REEVES built as a standard unit right into a Harton Cake Machine.

POSITIVE
in transmitting power

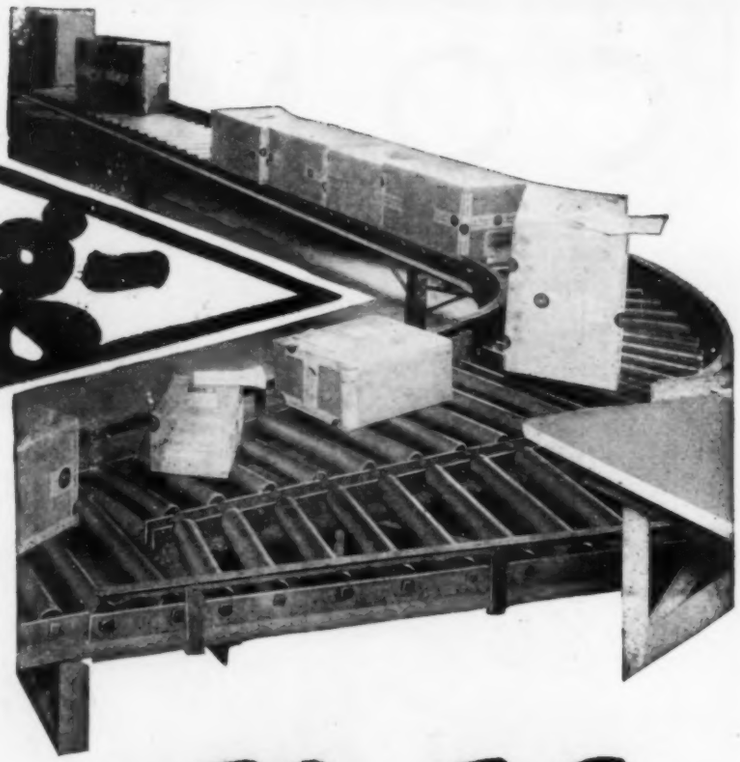
WITH the REEVES Transmission, any machine can be regulated instantly to run at any desired speed between predetermined limits of fast and slow. It will maintain any one set speed with *positive* accuracy . . . (A) shows the power input shaft which is driven at a constant speed . . . (B) shows the V-belt which *cannot slip* in the V-shaped throat formed by the cone-faced discs . . . (C) shows the power output shaft which remains constant at any one set speed, but which can be regulated, at the will of the operator, to any desired speed.



REEVES
Variable Speed Transmission

REEVES PULLEY COMPANY, *Columbus, Indiana*
Send your new catalog, C-88, and specific information about the_____(industry).
*Name*_____ *Company*_____ *Address*_____

Strong- *therefore* reliable



Some of the Construction Features:

Three-point, sensitive ball bearings. Sturdy angle iron frame. Large diameter steel through shaft with patented locking feature. Ball bearings—Grease Packed with protecting shield and brass fittings for easy grease renewal (where conditions necessitate lubricated or protected bearings).

The well planned construction of Standard Conveyors, all types, is the reason for their success under the most severe service conditions. If you will check over a Standard Conveyer you will see how our engineers designed it for dependable operation.

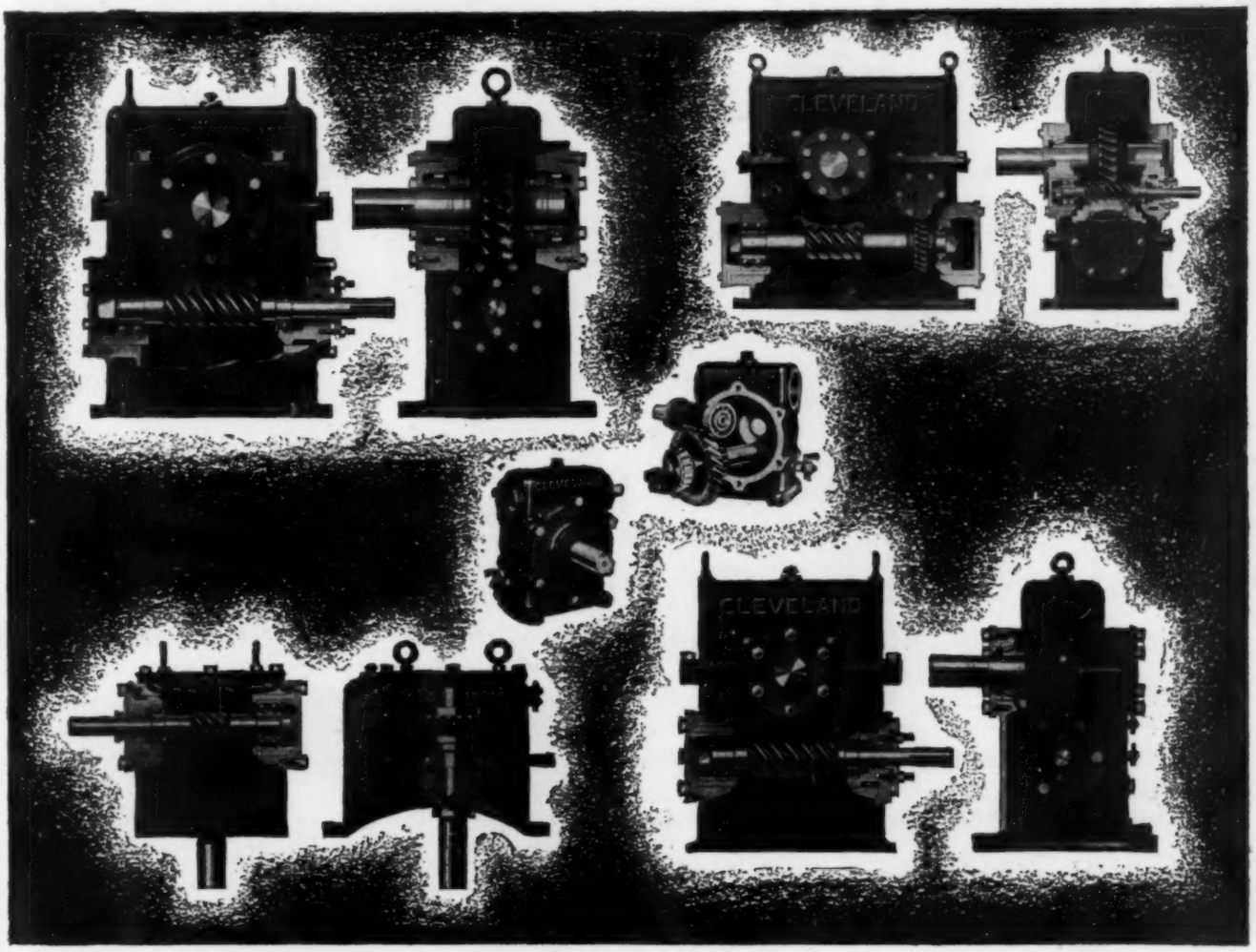
Our Conveyor Counselors will tell you of the economy of Standard Conveyor Systems in a variety of installations. There is no obligation attached to a request for a survey.

STANDARD CONVEYOR COMPANY

NORTH SAINT PAUL, MINNESOTA

Baltimore Office, 15 W. Franklin St.
Boston Office, 755 Boyiston St.
Buffalo Office, 908 Ellicott Sq.
Chicago Office, Daily News Bldg. 400 W. Madison St., Room 2350
Cincinnati Office, 907 Chamber of Commerce Bldg.
Cleveland Office, 5005 Euclid Ave.
Dallas Office, 6313 Oram St.
Detroit Office, 420 U. S. Mortgage Bldg.
Kansas City Office, 215 Mfr. Ex. Bldg.
New Orleans Office, 1003 Magazine St.
New York Office, 420 Lexington Ave.
San Francisco Office, 4401 San Bruno Ave.
Seattle Office, 321 Lumber Ex. Bldg.
Philadelphia Office, 2401 Chestnut St.

There's a Cleveland Speed Reducer for Every Job



AFTER all "the shouting and the tumult dies," the plain fact remains that Cleveland Worm Gear Speed Reducers are universal in their application. From a drive for a 100 horsepower crane in a steel mill to a 7/10 horsepower dish sterilizer in a restaurant kitchen is a far cry. But "Cleveland" fits them both, as well as the thousands of applications in between.

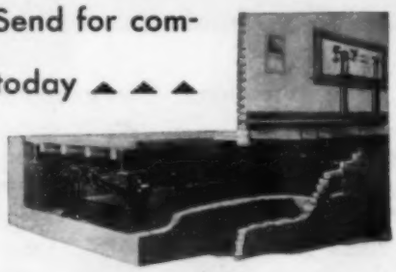
The question is no longer, "which kind of speed reducer to buy?" but "which type of Cleveland is the right application for the given requirements?" "Cleveland" users can always have the right answer because "Cleveland" engineers have available the most complete range of worm gear speed reducers in the world—eight standard types—forty-eight standard sizes and more than 500 standard ratios. Unless your requirements are most unusual, you will find a standard Cleveland size to fit your needs.

CLEVELAND
WORM & GEAR COMPANY

3251 East 80th Street, Cleveland, Ohio

FIND OUT...

for yourself why Buffalo Scales will relieve you of all worries about incorrect weights. ¶ Find out how and why they will minimize "shut-downs" for repairs. ¶ Learn, first-hand, why, after the most critical comparisons, many of the foremost railroads and industries in the country have chosen them. ¶ Get the facts about the Buffalo Suspension Bearing, widely recognized as the simplest in use today. Let it tell its own story of INCREASED accuracy thru REDUCED friction. ¶ You want permanent accuracy, enduring strength, trouble-free performance in your weighing equipment. Buffalo Scales will give them to you. Find out EXACTLY why. ¶ Send for complete information today ▲ ▲ ▲



The Buffalo Standard Motor Truck Scale for shallow pit installations.

BUFFALO SCALES

"the Trustworthy"

BUFFALO SCALE COMPANY, INC.

BUFFALO, N. Y.

Branches:

NEW YORK PITTSBURGH CLEVELAND CHICAGO
DETROIT SYRACUSE DALLAS

Chosen by the Engineers . . . .
Approved by the Plant Officials . . . .

Mitco Interlocked Steel Grating and Mitco Shur-Site Stair Treads

FOR installation in the plant of Riverside Cement Company, Riverside, California, Mitco Interlocked Steel Grating and Mitco Shur-Site Stair Treads were selected by Hunt, Mirk & Company, Engineers, of San Francisco. Their choice was approved by the officials of Riverside Cement Company.

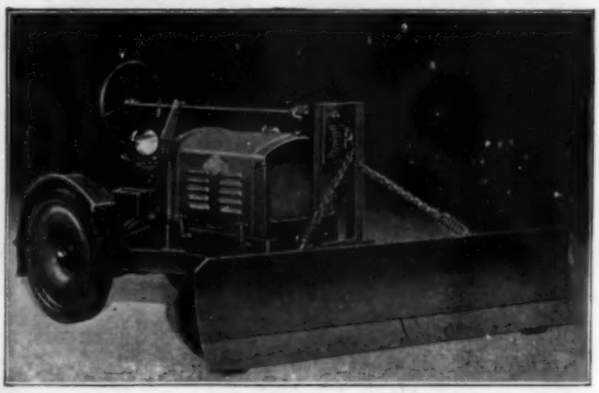
Engineer and customer both appreciate the superiority of Mitco Grating and Treads—high strength and rigidity, maximum light and ventilation, and non - slipping and non - clogging surface. Write for a copy of the Mitco bulletin.

HENDRICK MANUFACTURING CO.
53 Dundaff Street, Carbondale, Pa.

New York Office: 15 John St., 'Phone Cortlandt 2440
Pittsburgh Office: Union Trust Building
Chicago Office: Railway Exchange Bldg., 'Phone Wabash 5768

Offices in Principal Cities. Consult Telephone Book.

Makers of Mitco Armorgrids, Hendrick Perforated Metal Screens and Elevator Buckets of all types.



"Clarktor" Snow Plow (Code: "Snow") Length of blade 82 in. Width of swath 74 in. Gas powered. Standard "Clarktor" chassis.

"Clarktor" Snow Plow

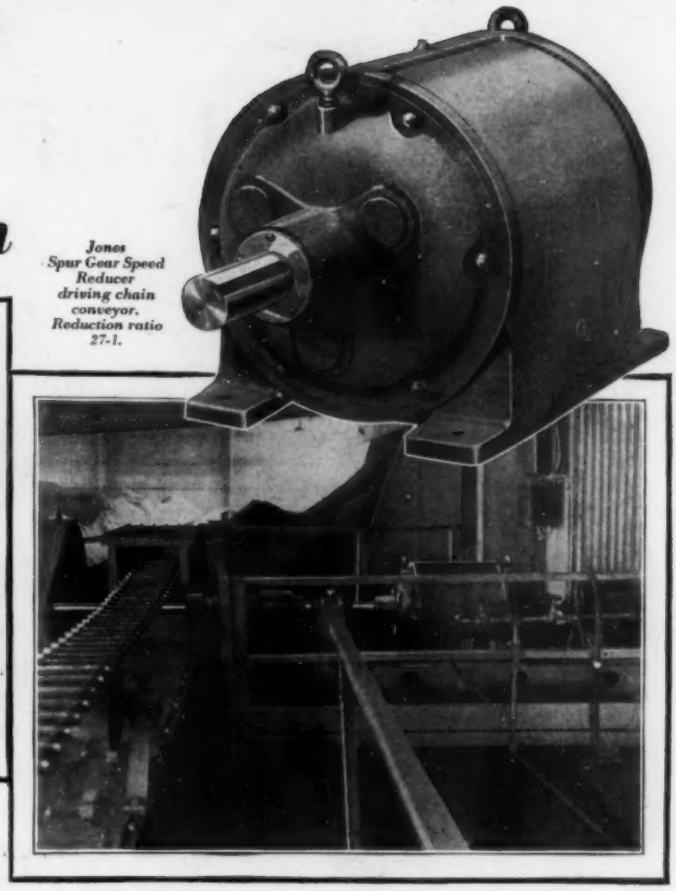
A Tractor When the Sun Shines
A Life Saver When Snow Falls

When you need a snow plow you need it badly. This "Clarktor" model doing general hauling duty becomes a snow plow in a few minutes whenever the emergency arises. Prevents interference with your work by the weather;—clears a path six feet wide in the time it would take a gang of men with snow shovels to put on their coats. One man drives and controls the blade. Secure full details by clipping this ad and sending it with your name and address to

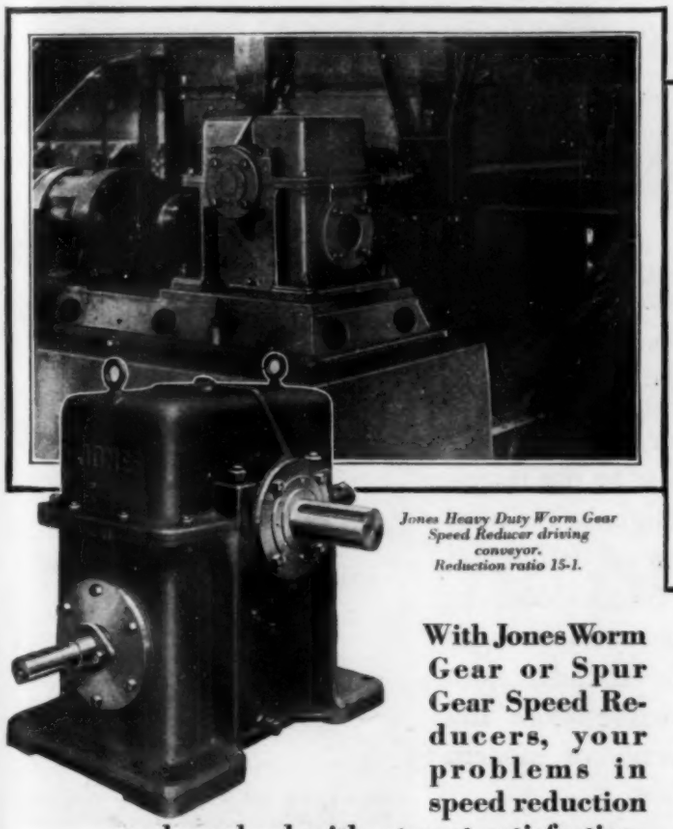
CLARK TRUCTRACTOR COMPANY
BATTLE CREEK, MICHIGAN

TEAM MATES

...in Efficient Speed Reduction



Jones Spur Gear Speed Reducer driving chain conveyor. Reduction ratio 27-1.



Jones Heavy Duty Worm Gear Speed Reducer driving conveyor. Reduction ratio 15-1.

With Jones Worm Gear or Spur Gear Speed Reducers, your problems in speed reduction can be solved with utmost satisfaction.

The many economies effected by these reducers in lower installation and operating costs, combined with greater power transmission efficiency, enable them to quickly pay for themselves. They are self-contained, self-lubricated units requiring no attention other than occasional refilling of the oil bath.

Jones Spur Gear and Worm Gear Speed Reducers are correctly designed, simply and durably built of high quality materials. They will give you long, trouble-free service.

Jones Speed Reducers are made in a great variety of standard ratios, with parts in stock ready for immediate assembly and shipment. Write for catalogue.

W. A. JONES FOUNDRY & MACHINE COMPANY

Main Office and Works: **4416 W. Roosevelt Road, Chicago, Ill.**

Branch Sales and Engineering Offices:

NEW YORK CLEVELAND MILWAUKEE PITTSBURGH BUFFALO DETROIT BIRMINGHAM
ST. LOUIS CINCINNATI KANSAS CITY, MO. LOS ANGELES SAN FRANCISCO

Jones Speed

Spur & Worm Gear Reducers

Sectionalized Construction

means
pre-proved performance
in every
Compact Hoist

All Shepard Compact Hoists are duplicates—in performance. This is one of the benefits of unit construction.

From the smallest to the largest there is not the slightest variation in the standards of design and construction. Every Compact Hoist is fortified with strength and stamina in abundance, to resist the inevitable abuse and continuous severity of modern industrial practice.

Shepard Compact Hoists require a minimum of maintenance. All moving parts operate in an oil bath to insure proper lubrication. Cooling fins have been added to the load brake and heat treated steel gears are used in the planetary train. And the instant, positive response to controls is a feature that every hoist user will appreciate.

Shepard representatives are located in the principal cities from coast to coast. They will gladly assist you in applying the Compact Hoist precisely suited to your job.

SHEPARD NILES CRANE & HOIST CORPORATION
382 Schuyler Ave., Montour Falls, N. Y., *Works:* Montour Falls, N. Y., Phila., Pa.

SHEPARD
CRANE & HOIST DIVISION

Member EIMA
ELECTRIC HOIST MANUFACTURERS ASSOCIATION

Any port in a storm —

but—calm deliberation will show you that Westinghouse-Nuttall BP "tough-hard" gears give the surest protection against excessive production costs encountered when gears of an inferior quality are used. Large power losses, costly interruptions, frequent failures, and high maintenance expense are greatly reduced.

BP "tough-hard" gears are four times harder, will carry four times more load, and have three times more resistance to shock impacts than untreated gears of medium carbon steel.

This superiority is obtained by an exclusive heat-treating process which not only produces high surface hardness, but also *doubles both the tensile strength and the elastic limit.* BP "tough-hard" gears, consequently, are guaranteed to last four times longer than untreated gears in identical service, yet—they cost but slightly more.

Numerous well-equipped and efficiently-manned Service Shops throughout the country assure prompt SERVICE *to the purchasers of Westinghouse products.*

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
NUTTALL WORKS PITTSBURGH, PENNSYLVANIA
SALES OFFICES AND SERVICE SHOPS IN ALL PRINCIPAL CITIES
CANADIAN AGENTS: LYMAN TUBE & SUPPLY COMPANY

Westinghouse

T-30726

"SAFETY FIRST" IN PUMPING NAPHTHA!

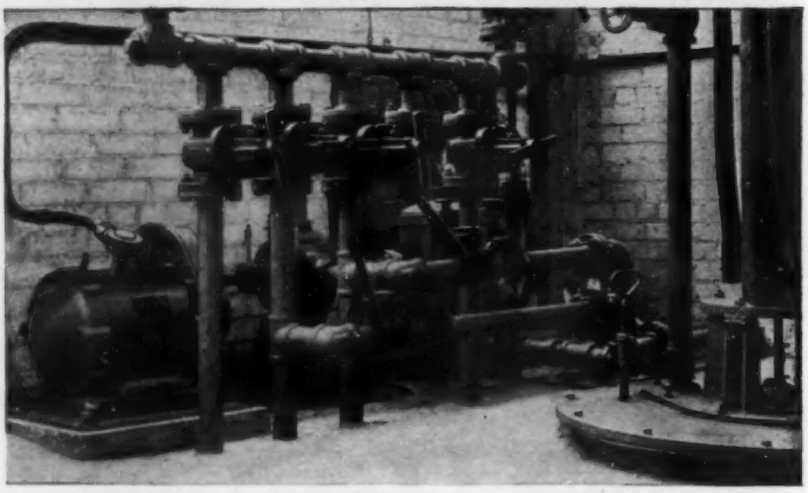
"SAFETY first" was the rule in selecting the drive for the naphtha pump here shown. Consequently the designing engineer rejected every drive that might create a spark and ignite the surrounding flammable vapors.

This eliminated belt drive because of sparks resulting from belt static. And *ordinary* electric motors were out of the question because of possible sparks from grounds, burnouts, and short circuits.

The Louis Allis "Explosion-Proof" or Type E motor was selected because its safety under these conditions is assured by the severe tests and definite approval of Underwriters' Laboratories.

Make "Safety First" the rule in *your* plant. Standardize on L.A. "Explosion-Proof" motors for operation wherever volatile flammable liquids are made, used, or handled.

Write for full information.



PUMP of well-known make used for handling naphtha and other volatile solvents. Equipped with Louis Allis "Explosion-Proof" or Type E motor, which is approved by Underwriters' Laboratories for use in explosive atmospheres.

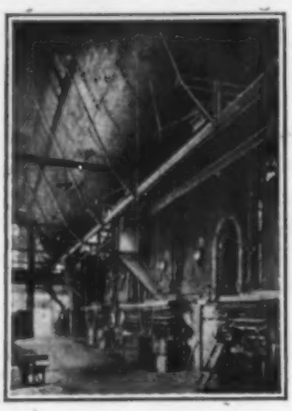
WARNING!

Do not confuse the Louis Allis "EXPLOSION-PROOF" Motor with so-called "vapor-proof" motors. Real "EXPLOSION-PROOF" motors must be specially constructed, and must pass severe explosion tests to be approved by Underwriters' Laboratories for use in explosive atmospheres.

LOUIS ALLIS

"EXPLOSION-PROOF" *Electric* MOTORS

THE LOUIS ALLIS COMPANY
MILWAUKEE, WIS.
Motor Specialists for 28 Years — 4 Offices in Principal Cities



WEBSTER

equipment for the power plant

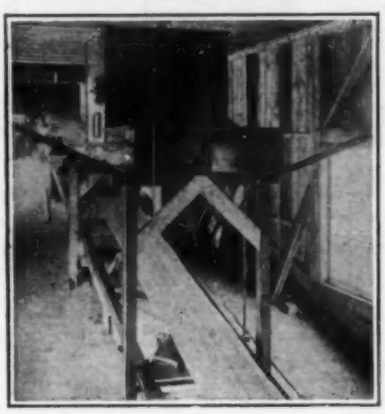
Weigh Larries
Perkins Pivoted Bucket Carriers
Coal Crushers
Skip Hoists
Coal Bunkers and Spouting
Bucket Elevator

etc., etc.

Our Engineering Department is At Your Service

THE WEBSTER MFG. COMPANY
1036 N. Kostner Ave., Chicago, Illinois

Weigh While You Convey
over
THE MERRICK CONVEYOR WEIGHTOMETER



Any material which is conveyor-handled can be weighed without additional handling or loss of time by the Merrick Conveyor Weightometer.

An Automatic—Continuous—Accurate Record

MERRICK SCALE MFG. COMPANY
168 Autumn St., Passaic, N. J.

THIS UNUSUAL PROBLEM *in Speed Reduction—*

A large automobile equipment plant installed a 1400 ft. conveyor for windshield frames. It contained twenty-one right angle turns, eleven double dips and traveled through a series of paint tanks and drying ovens. To operate this conveyor economically at the desired speed of less than two feet per minute, presented a serious problem.

. . . WAS SOLVED *with a* G & F UNIT

Yet it was found that the only equipment required to drive the conveyor consisted of a 3 horsepower motor and one G & F Planetary Speed Reducer. The main vertical head shaft is driven with a reduction in speed of 300 to 1, a sprocket attached to the upper end operating a chain, which drives the conveyor at another point halfway along the line and at a different elevation. The speed of the conveyor is 20½" per minute.

Such problems as this are being solved daily with G & F Speed Reducers. Our line is complete. We will be glad to assist you on any speed reduction job.

G & F Products:
Drop, Flat Hammer and Upset Forgings, Cut Gears
Speed Reducers
Rolling Mill Machinery
Special Machinery

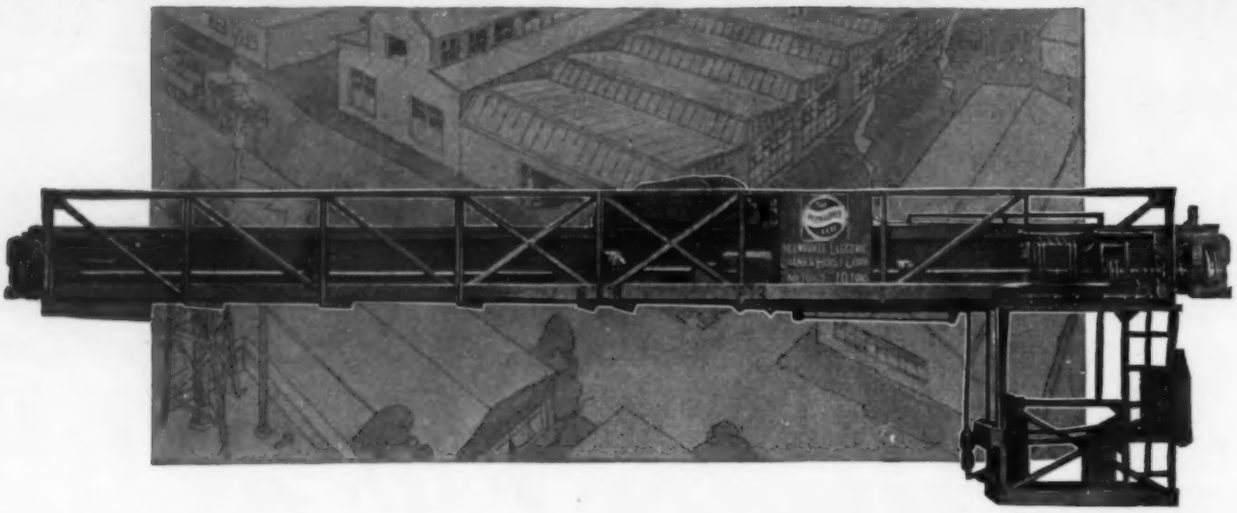
GEARS AND FORGINGS INC.

SPEED REDUCERS

GENERAL OFFICES
3022 WOODHILL ROAD
CLEVELAND - OHIO - U.S.A.

District Sales Offices: Chicago - Pittsburgh - Detroit - Buffalo - New York - Milwaukee - Indianapolis

SUBSTANTIAL SAVINGS IN INDUSTRIAL CONSTRUCTION



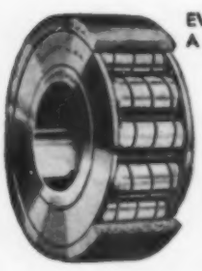
Are Accomplished By This Standard Low Headroom Crane . . .

The Milwaukee Type GOR Standard Low Headroom Crane requires overhead clearance as little as only 2′-11½″ for a 3 ton crane 30 ft. span; 5′-3″ for a 30 ton crane 60 ft. span.

Consider the substantial savings in building construction made possible by this remarkably compact crane. The height of new buildings can be materially reduced, with attendant savings in cost; existing buildings, where crane service is needed, need not be remodeled to accommodate a crane, since this Milwaukee Low Headroom Crane requires only a minimum of overhead clearance, usually available in factory structures.

Milwaukee Engineers, the first to produce a traveling crane with every bearing a roller bearing, foresaw the need for a traveling crane of this type. As fundamental requirements they set down these difficult specifications: minimum low headroom, maximum hook lift, all the elements of good crane construction in the way of safety, strength, and accessibility, every bearing a roller bearing, a design that could be established as standard, a sufficient range of capacities. The result was the Type GR Milwaukee Crane Trolley, capacities 3 to 30 tons. It is adapted to a standard crane bridge or, where extreme low headroom conditions demand it, a special crane bridge . . . Besides its features of low headroom and high hook lift the Milwaukee Low Headroom Type GR Trolley embodies all the advantages of roller bearings: less starting effort, lively acceleration, low cost upkeep, and power savings. Milwaukee believes this trolley to be an outstanding achievement in modern crane practice. May we send you descriptive bulletin?

Save 2 to 3 ft. Building Height With the Milwaukee Standard Low Headroom Crane



EVERY BEARING — A ROLLER BEARING

MILWAUKEE ELECTRIC CRANE & HOIST CORPORATION
MILWAUKEE WISCONSIN
Representatives in Principal Cities

HOISTS MILWAUKEE CRANES ROLLER BEARING CRANES

MILWAUKEE

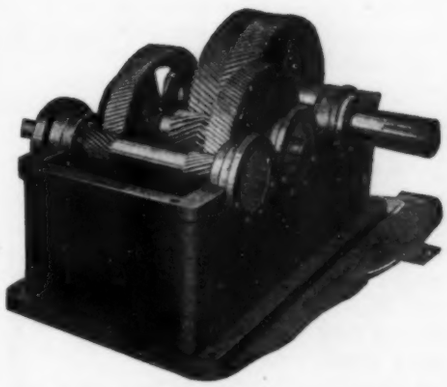
Low Headroom Cranes—3 to 30 Tons
Standard Cranes to 50 Tons

"We'll need four *different types* of speed reducers—"

and so they ordered—

Philadelphia
SPEED REDUCING UNITS
(ONE NAME-ALL TYPES)

Men who must keep things going and cut costs—men who want unbiased advice as to WHICH TYPE of Speed Reducer is best for THEM—are quick to see the advantage of dealing with "PHILADELPHIA." They quickly sense the fact that it is a big advantage to be able to select ANY TYPE of Speed Reducer from ONE maker. The fact that we make Worm, Spur and Herringbone types, Speed Reducers enables us to look at YOUR problem from YOUR viewpoint and to give you what YOU want. And our 50 years in the gear business and expert knowledge of metals and metal treatment enables us to produce cool running, quiet, flexible and power economizing Speed Reducing Units each the best of its type. Write for Speed Reducer Bulletins today.



We have added to our line of standard Speed Reducers,—Continuous Tooth Herringbone Gear Units, in which the gears are of the SYKES TYPE,—made of high carbon or alloy steel. The helix angle is 30°, which assures maximum tooth overlap and smooth, silent running. Maximum strength of teeth is secured by the unbroken tooth surface.

PHILLIE GEAR

Power Saving Products

GEARS, Spur, Worm, Herringbone, Internal, Bevel, Miter, Intermittent, Spiral, Helical, Continuous Tooth Herringbone Gears.
NON-METALLIC PINIONS: Fabroil, Textolite Rawhide.
Ground Thread Worms, Whitney Silent and Roller Chains, Sprockets, Flexible Couplings, Universal Joints, Racks, Ratchets and Pawls, and a complete line of gear driven
SPEED REDUCING UNITS

AGMA

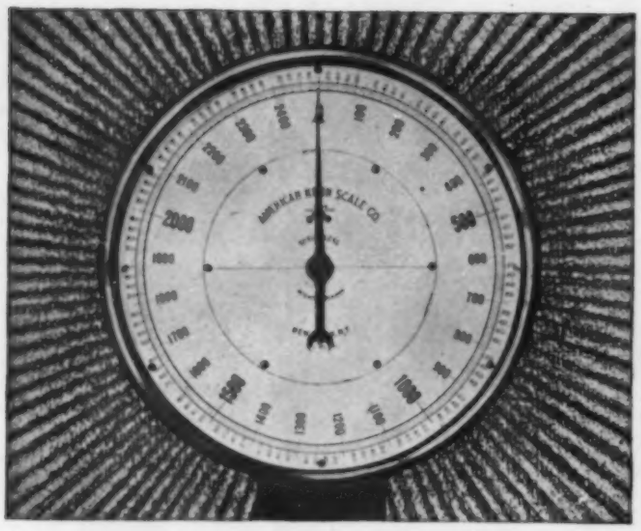
Main Office and Plant Erie Ave. and G St. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Offices:
NEW YORK—12 E. 41st Street PITTSBURGH, PA.—Farmers Bank Bldg.
DETROIT—Donovan Bldg.



Load and Look—
that's
MODERN WEIGHING!

BUT, when you look, be sure that what you see is accurate. It will be, if the scale is a Kron Automatic Dial Scale.

The dependable accuracy of the Kron Scale is due to exclusive, patented features that no other scale manufacturer can duplicate. That's the reason why leaders in all industries are using and repeating on Kron Scales. For speed, accuracy and economy in weighing Kron Automatic Industrial Scales stand alone.

Inaccurate scales would be costly even if they were given to you. Accurate weighing of anything, anywhere, is a simple matter of "load and look" with the Kron Scale. In numerous instances Kron Scales have cut weighing costs in half.

That's the kind of weighing service we urge you to investigate by writing today for the Kron literature.

KRON SCALES

Points that ensure accuracy:

1. Automatic and springless.
2. Weighing mechanism interchangeable and standardized for all Kron Scales, regardless of size or capacity.
3. Cam adjustment insures absolute accuracy.
4. Indicator is perfectly balanced.
5. Dust protectors keep dust from bearings.
6. Frictionless rocker knife edge bearings.
7. Non-leakable dash pot absorbs all shocks.
8. Suspension type platform.
9. Rugged construction.
10. Built to fit the weighing job.

AMERICAN KRON SCALE COMPANY
430 East 53rd Street, New York

BRANCHES: Atlanta — Boston — Chicago — Cleveland — Charlotte — Detroit — Kansas City — Los Angeles — Milwaukee — Minneapolis — Philadelphia — Pittsburgh — St. Louis.

KRON
LOAD AND LOOK SCALES

STURTEVANT MILL CO.

16-20 Harrison Sq., Boston, Mass.

[FREE Technical Pocket Library on following machines; all new developments and production short-cuts; literature contains engineering data on application and performance essential to wise purchasing; Laboratory Test on full sized machines free.]

CRUSHERS: Jaw, Rotary, Sledge, Hammer, Rolls, etc.

PULVERIZERS: Ring Roll, Hammer, Sledge, Rock Emery Mills—with internal and external screens; with incorporated or independent Air Separators.

SCREENS: Vibrating, Shaking, Inclined, Revolving, Bumping, and Rotaries.

AIR SEPARATORS: Low Speed, for coarse or fine work—low power consumption, enormous capacities, 6 major improvements.

ELEVATORS: Steel and Wood—Vertical or Inclined; Drag, Chain, Belt, Bucket; all types with Open Door construction.

CONVEYORS: *Mixers; Auxiliaries; Laboratory Equipment*

Standardized Units of Major Machines and Auxiliaries

Engineers, plant design, layout erection, operation, consulting.

Ask for FREE Technical Pamphlets and Catalogues on machines wanted.

Continuous Power

—the reward of constant testing of materials . .

The TS-10A Transformer is a complete testing set for all commercial and laboratory tests from 500 to 50,000 volts. Originally designed by American Transformer engineers for one of the world's largest cable manufacturers. With modifications and improvements suggested by experience in operation it is now standard equipment for makers of cable, insulation, electrical apparatus, and for power company laboratories. Quickly and easily adjusted, the TS-10A Test Set saves valuable time, and, often, the cost of additional testing apparatus.

TS-10A Test Set

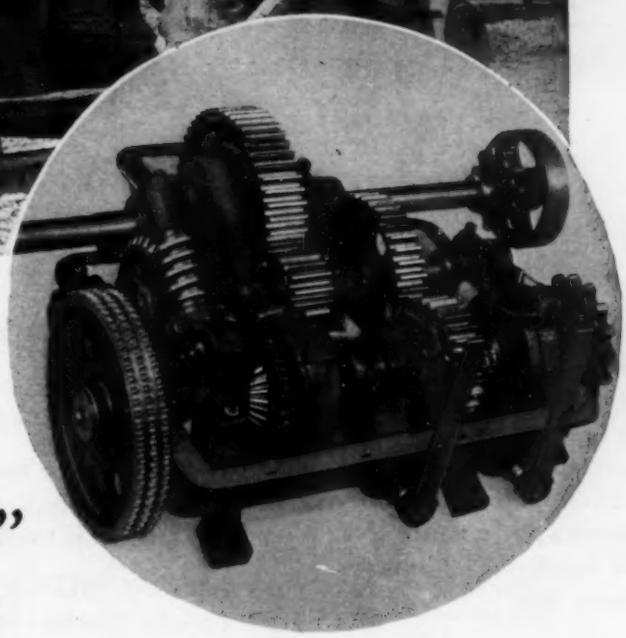
5 to 25 KVA, 220 primary, 60 cycle; 12,500/25,000/50,000/3,000/1,500/1,250 secondary. This set has two high voltage transformers (one a main testing transformer, the other an auxiliary testing transformer). Controlled by induction regulator.

Complete information about this and other special industrial transformers is contained in our Bulletin 1130, mailed on request.

There is an American Transformer for every laboratory and industrial application.

AMERICAN TRANSFORMER COMPANY
186 Emmet Street Newark, N. J.

AMERICAN TRANSFORMERS



HAISS says:

"For Tough Going, Earle Gears Get the Call"

No mechanical equipment can put gearing to a sterner test than the handling and conveying machines produced by the George Haiss Manufacturing Company of New York. On the job in all kinds of weather, under all kinds of conditions—handled indiscriminately by all kinds of operators—quick starts and jerky stops put a strain on transmission units that demands super-stamina from the gears.

The selection of Earle Gears for this demanding work is justified by the fine reputation enjoyed by Haiss products everywhere. Superior materials, superior designs, and superior construction are Earle Gear characteristics that give them the call wherever gear service *must* be of unfaltering dependability.

Specify Earle Gears on every requirement from 1 inch to 34 feet. Your blue-prints will bring an estimate well within reasonable price limitations.

The Earle Gear & Machine Co.

4721 Stenton Ave., Philadelphia, Pa.

New York Boston Birmingham Plymouth

EARLE GEARS

TRADITION

PROGRESS

"Linc-Weld" Superiority is due to:

1. Larger Shaft through Motor
2. Larger Bearings
3. Better Insulation
4. Stronger Frame (Steel)
5. Greater Overload Capacity

"Here, Lad—

You've been talking a lot about the 'Linc-Weld' motor. That's just a name to me. It's got to a point now where we've got to forget names of motors and on our service put a motor that is head and shoulders over any."

"Fine, Pop—

That's the 'Linc-Weld', only it's a longer distance than head and shoulders.

It's HEAD over motors in general because in the scramble to get refrigerators, switchboards, etc., into the STEEL class, the Lincoln is the first MOTOR to drop into this better class.

It's SHOULDERS ahead because when a 'Linc-Weld' puts its shoulder to the wheel—'taint foolin'.

And, when you consider its superinsulation—its greater overload capacity, larger bearings and shafts—well, you've got to think of a new measurement.

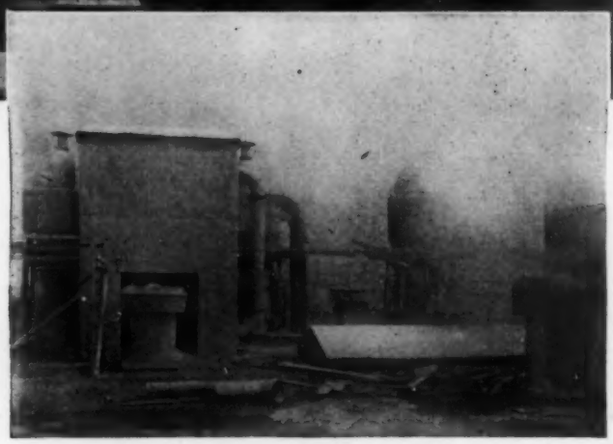
I see where a New York Physicist claims that no two objects in the universe can be more than 54,000,000,000,000,-000,000 miles apart—which shows that he's never attempted to measure just how far the 'Linc-Weld' is ahead.

THE LINCOLN ELECTRIC COMPANY
Department No. 6-12 CLEVELAND, OHIO

M-55

LINCOLN
"LINC-WELD" MOTORS

DRACCO *equipment to be installed will make this plant dust-free*



The top picture shows the extremely bad condition created by discharged phosphate dust. In the picture directly above four cyclone vents are shown—the two on the left having the trial Dracco filter equipment, the two on the right without. Note the absolute freedom of dust discharge from the two filter-equipped cyclones.

...and valuable phosphate fines now wasted will be saved

It required only a trial installation of one 2-compartment Dracco filter to prove conclusively that here was the solution to a troublesome, costly condition that existed in the Davison Chemical Co. phosphate plant at Baltimore, Md.

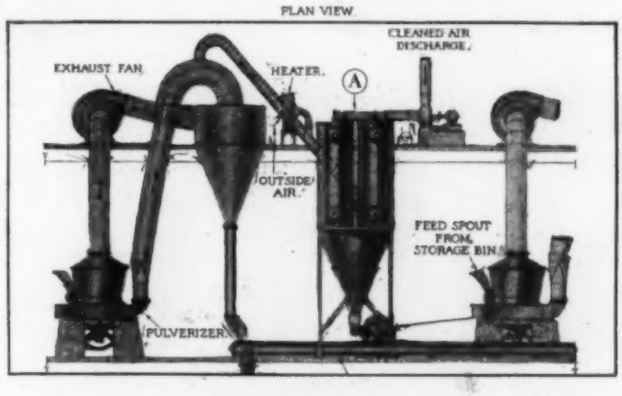
Dust, from 12 Raymond mills, grinding phosphate rock, discharged through 12 cyclone vents resulting in a large annual loss in phosphate and creating nuisance throughout the entire plant.

The trial installation was applied to two cyclones and proved so successful that this company has ordered 5 more 2-compartment filters to take care of the other 10 cyclones.

Here, again, Dracco turns a liability into assets—eliminating a dust nuisance that meant highly unsatisfactory working conditions and turning back for profit the valuable phosphate fines which formerly were lost.

Wherever there is a dust and fume nuisance—wherever values are being carried out in dust and fumes—wherever dry bulk materials call for conveying—Dracco offers a solution.

Investigate today. Write for bulletins covering your problem.



DUST RECOVERING and CONVEYING CO.

ENGINEERS and MANUFACTURERS

CLEVELAND OHIO

DUST ELIMINATION — VALUE RECOVERY — PNEUMATIC CONVEYING

A FEW MONTHS AGO WE TOLD YOU ABOUT

A Repeat Order for TEN -UNIQUE CUSTOM BUILT MIXERS

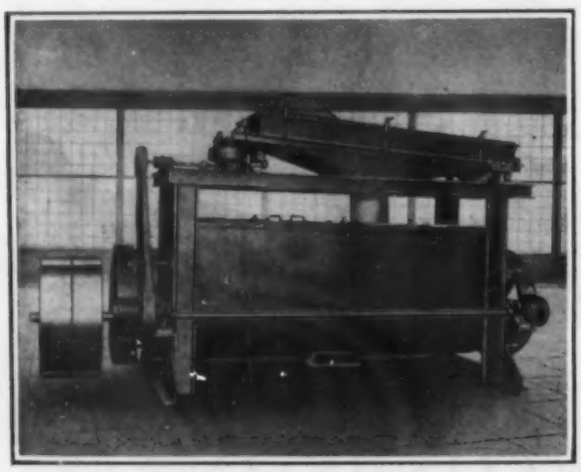
By CUSTOM BUILT we mean "Made to Meet Every Mixing Need." If you need a special mixing mechanism, we will design it,—and if your installation is unusual, we will build the mixer to suit the space.

AND NOW—Another "Repeat" Order for SIXTEEN Additional Mixers

There could be no finer or more conclusive proof of perfect adaptability of UNIQUE Mixers to Intricate Mixing Problems.

Another intricate mixing problem successfully solved by UNIQUE Engineers. Light, fluffy pieces had to be intimately associated and at the same time saturated evenly with a chemical solution. UNIQUE Mixers do the job well.

These three large size special mixers form part of a repeat order for ten UNIQUE Mixers to complete the processing of a new material receiving nation-wide acclaim. The bodies are made of wood while the ends and all other parts which come in contact with the material are made of bronze to resist the chemical action. Another later order called for a number of still larger machines to be made with stainless steel bodies. And now SIXTEEN more.



Another proof of UNIQUE Efficiency is given in the illustration at the left, showing a combination of the UNIQUE Gyro-Sifter and Heavy Duty Mixer with roller bearings, used for intimately associating accurately sized particles. Repeat orders for UNIQUE Equipment in this plant for manufacturing soap powders total six special Mixers, Gyro-Sifters, Saw Tooth Crushers, Dust Collectors, etc.

If YOU have a problem in Mixing, Sifting, Crushing, Grinding, Elevating or Conveying, we would like an opportunity to show you some real engineering and advisory service.

Write us. We will gladly send literature on UNIQUE Machines for any of the above operations.

UNIQUE

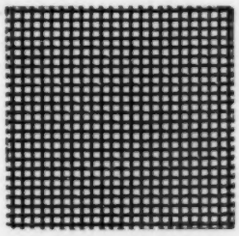
ROBINSON MFG. CO.

72 PAINTER STREET, MUNCY, PA.

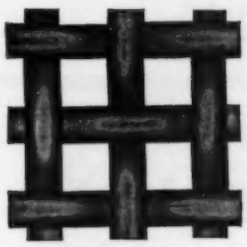
MANUFACTURERS OF PROCESS EQUIPMENT

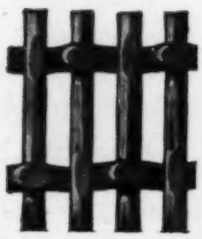
Crushers, Grinders, Pulverizers, Sifters, Reels, Mixers, Elevators and Conveyors

UNIQUE



ARE YOUR DOLLARS SLIPPING THROUGH YOUR SCREENS?





If your screening or sifting isn't up to the efficiency that marks the operation of Cleveland screen equipped equipment then dollars are literally slipping through your screens.

For every operation requiring wire cloth, you can be sure of maximum efficiency—a better product, longer life and less replacement —with "Cleveland" Wire Cloth.

Under the unusual circumstances of experienced skilled weavers and the most modern manufacturing facilities Cleveland has developed a full line of wire cloth—strikingly distinctive for its uniform mesh, variety of weaves and remarkably long service.

Cleveland screen is manufactured in Steel, Brass, Copper, Monel, Nickel and Phosphor Bronze—a material for every condition—a weave for every requirement.

The Cleveland Wire Cloth & Mfg. Co.
3574 E. 78th St., Cleveland, Ohio

Cyclone Collector for Handling Hot or Heavy Granulated Dust

NORBLO

REGISTERED TRADE MARK

We've Probably Solved Your Problem Before

NO MATTER how "special" your dust or fume removal problem may be, we've probably had it "licked" before.

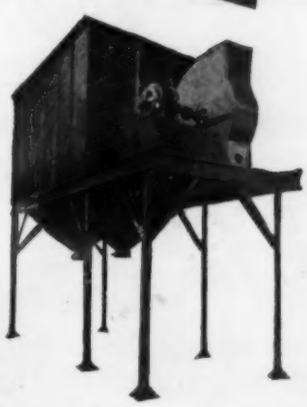
If we haven't, we'll undertake to solve it for you.

In either case, we'll GUARANTEE that you will be fully satisfied with the results.

Put Your Dust and Fume Removal Job up to us

High Efficiency Air Filter for Continuous Recovery of Fine Dust

Separator for Removing Oversized grindings from Fine Dust



Screen Arrester for Recovery of Fine Dust. (For ordinary conditions.)

There's a NORBLO for Every Need -- Yours, too

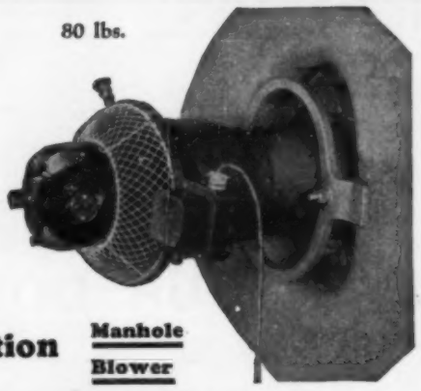
Northern Blower Co. **6500 Denison Avenue CLEVELAND, OHIO**

Heat Killer
118 lbs.

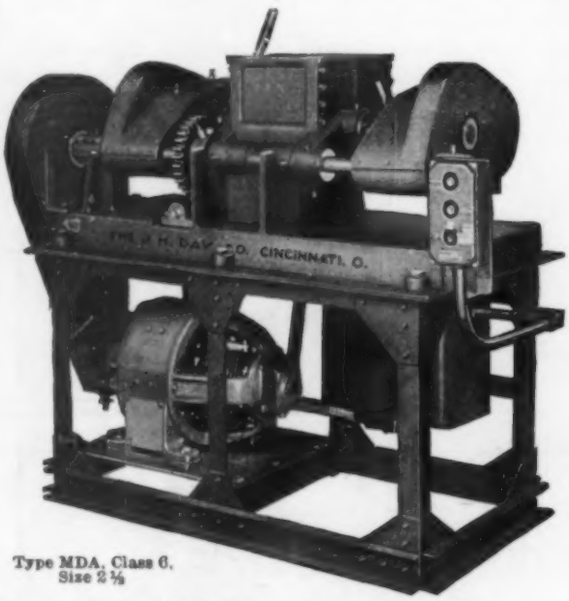
For cooling, drying and ventilating of kilns, driers, cracking stills, dehydrating pots, etc... For expelling fumes, gases, dust and heat.

Coppus Engineering Corporation
364 Park Ave., Worcester, Mass.

80 lbs.



Manhole Blower



Type MDA, Class 6, Size 2½

Numerous types of agitators can be used in one Mixer requiring only a short time to make the change.

DAY
Mogul Experimental Mixers

Interchangeable and Reversible AGITATORS

Experimental work on the greatest variety of masses, such as nitrocellulose jellies, battery box compositions, watery rubber dispersions, shellac compositions, storage battery pastes, etc., is simplified by the interchangeable and reversible agitators. Your request for detailed information carries no obligation except ours, to furnish it promptly.

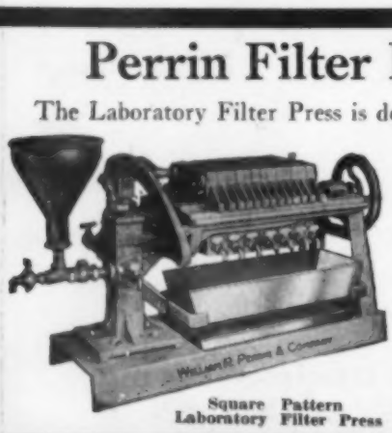
Write for descriptive circular CM-1.

THE JHD CO

THE J. H. DAY COMPANY
Factories and Principal Offices
CINCINNATI, OHIO.

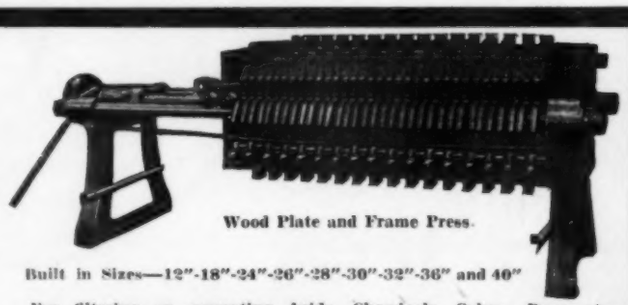
Perrin Filter Presses

The Laboratory Filter Press is designed for practical laboratory tests and quick determination of percentages desired in the use of certain materials.



Square Pattern Laboratory Filter Press

Built of Iron or Brass in both Round and Square Patterns



Wood Plate and Frame Press

Built in Sizes—12"-18"-24"-26"-28"-30"-32"-36" and 40"

For filtering or separating Acids, Chemicals, Colors, Dyes, etc., where liquid or material should not come in contact with metal.

We Solicit Your Specifications for Our Prices

WILLIAM R. PERRIN & COMPANY
W. 23rd St. and Stewart Ave., Chicago, Illinois

Rush ten cornerless testing sieves, exactly like the one received today.

Here is a testing sieve that is truly "cornerless." A smooth rounded surface joins the bottom with the frame. There are no sharp corners. No sticking or holding of materials. Less time is required to do the testing. Maximum effectiveness and economy are attained.

All soldering is on the outside, therefore bottoms are easily renewed.

Owing to the perfection of design of this new Newark Testing Sieve there is no deformation of the wire cloth. The sieve is always accurate throughout its long life.

NEWARK Testing Sieve

This new Newark Testing Sieve is made in all sizes and meshes in accordance with the specifications of the United States Bureau of Standards and the American Society of Testing Materials. Many of the sizes are carried in stock so that we can ship promptly upon receipt of order.

Where desired we furnish frames of Monel Metal, and the wire cloth itself, in market grade sizes, is made of Monel Metal.

For complete information on these testing sieves as well as all other Newark Wire Cloth Co. products ask for a copy of Catalog No. 26.

Newark Wire Cloth is made in all meshes, all weaves, all lengths, all widths, and of all malleable metals such as Monel Metal, Aluminum, Brass, Copper, Bronze, Phosphor Bronze, Nickel, Steel, Manganese Steel, Silver, Gold, Platinum, Nickel Chromium, Tinned Metals, Special Alloys.

NEWARK

Newark Wire Cloth Company

350-364 Verona Ave., Newark, N. J.

Branch Office: 66 Hamilton St., Cambridge, Mass.

Newark Wire Cloth Co.,
350-364 Verona Ave., Newark, N. J.

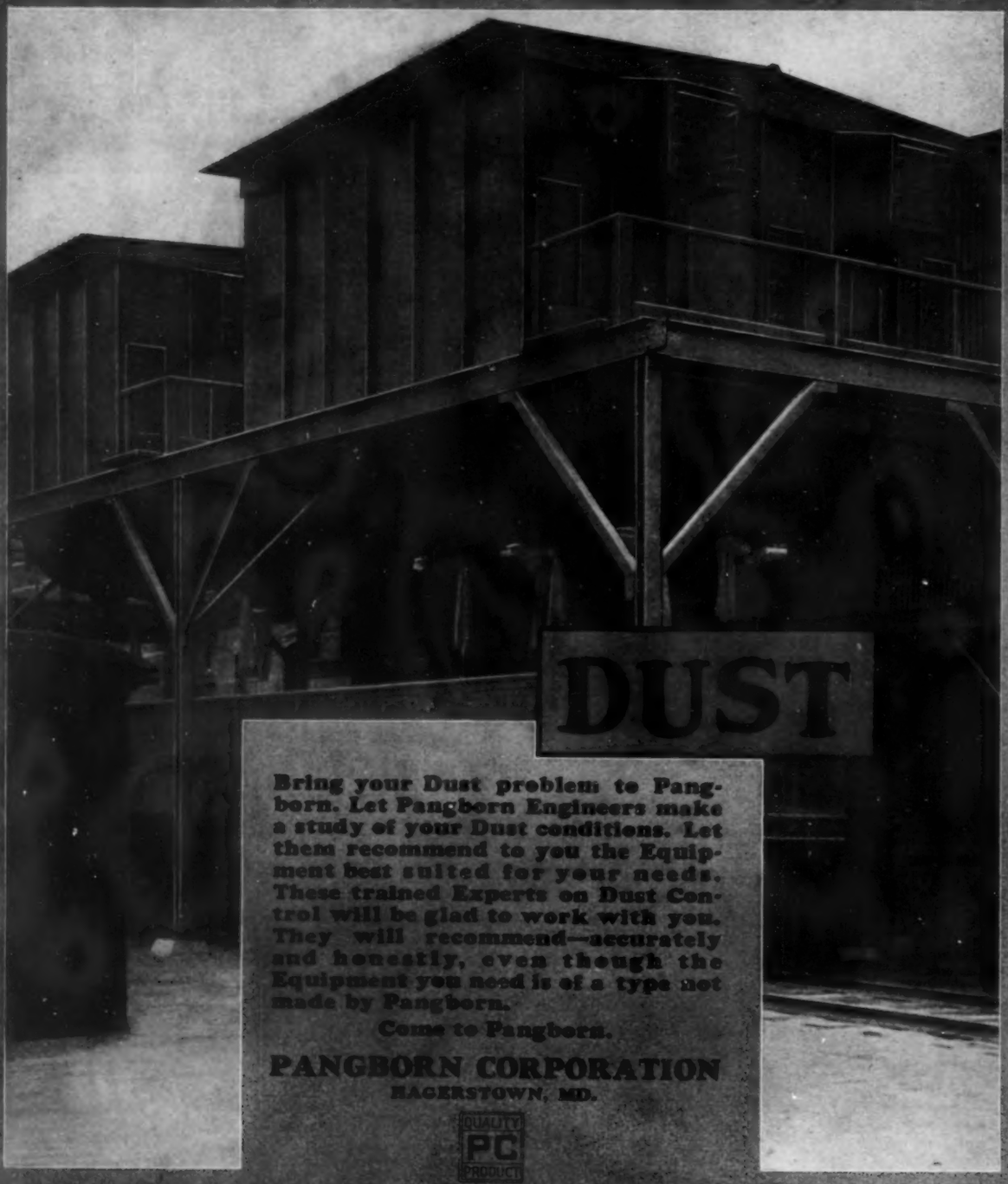
Without obligating us in any way please send a copy of your catalog No. 26. We are interested in:

- ☐ The "Newark" Cornerless Testing Sieve.
- ☐ The finest wire cloth in the world—400 mesh—160,000 square openings per sq. in.
- ☐ "Newark" Metallic Filter Cloth.
- ☐ Gasketed Metallic Filter Cloth.

Name ..... Street .....

Firm ..... City and State .....

Short would be the trail of a baby's feet in the plant where dust remains an unsolved problem. The lungs of your workmen may endure dust for a longer time, but it exacts its toll nevertheless. Man cannot perform efficiently with dust in his lungs. Yet, you are paying for a Dust Collecting System whether you install it or not!



DUST

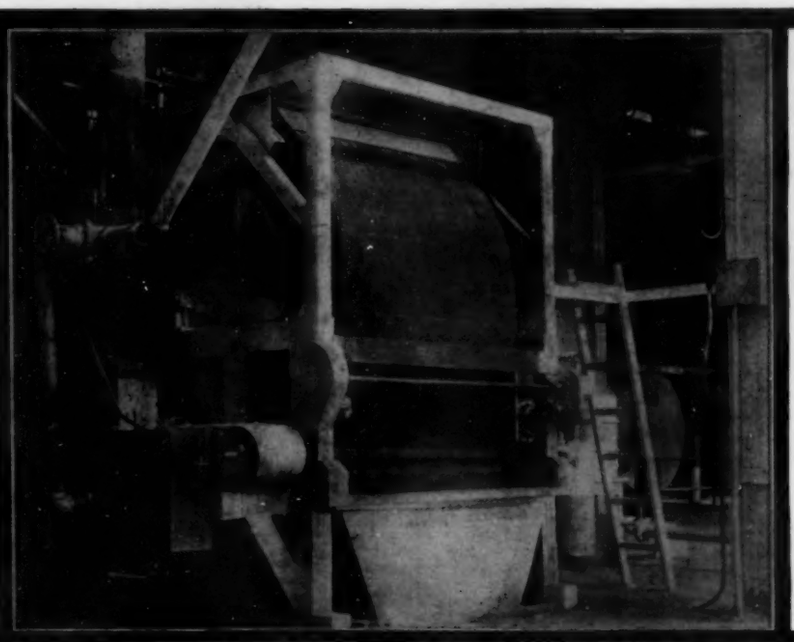
Bring your Dust problem to Pangborn. Let Pangborn Engineers make a study of your Dust conditions. Let them recommend to you the Equipment best suited for your needs. These trained Experts on Dust Control will be glad to work with you. They will recommend—accurately and honestly, even though the Equipment you need is of a type not made by Pangborn.

Come to Pangborn.

PANGBORN CORPORATION
HAGERSTOWN, MD.

QUALITY PC PRODUCTS

PANGBORN



An excellent example of modernization, and also of Oliver United's development work: new, continuous cane-mud or "cachaza" filter now being adopted by cane sugar producers.

Modernize Your Filter Station

OBSOLESCENCE is measured by efficiency, not by years. Your filter station may be an old one yet as efficient as it is possible to make it. On the other hand, it may be shy of the efficiency you would like.

A new filter type may be the answer.

Oliver United engineers will be glad to advise on this matter. They know every angle of filtration. They have at your disposal many types of filters, some one unit of which may be a better type for your particular problem.

Modernizing filtration pays. Why not discuss the filtering end of your process with Oliver United engineers?

OLIVER UNITED FILTERS INC.

SAN FRANCISCO
Federal Reserve Bank Bldg.
NEW YORK
33 West 42nd Street
CHICAGO
565 Washington Blvd.
LONDON, W. C. 1
150 Southampton Row
PARIS
63 Ave. des Champs Elysees
T. L. Genter, Concessionaire

Factories: Oakland, Calif., Hazleton, Penna.
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Johannesburg, E. L. Bateman
Tokyo, The American Trading Co.
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Manila, E. J. Nell & Co.
Timmins, Ontario, B. D. Kelly
Halle, Germany, Wilhelm Lill
Scheveningen, Holland, Soerabaia, Java } Van Lelyveld and Co.
Recife, Brazil, Ayres and Son

Why We Were Chosen

One of the foremost chemical engineering companies in the U. S. recently placed with us the largest order for mixing machines which, to our knowledge, has ever been placed in peace time. They chose Baker Perkins because,

1. Our plant and manufacturing facilities are completely adequate, thoroughly modern, and manned by a crew of highly skilled workmen.
2. Our engineers know how to design mixing machinery to meet the special requirements of our clients.
3. We have, through our international affiliations, a background of knowledge and information on mixing problems and machine design that is world wide.
4. We stand back of every machine we build.

BAKER PERKINS CO., Inc.

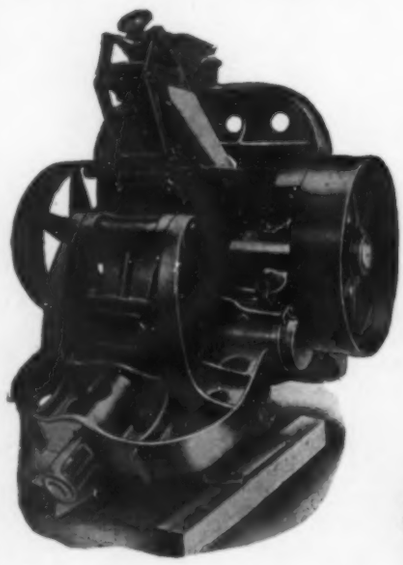
WERNER & PFLEIDERER DIVISION

250 Park Avenue
NEW YORK
2004 Conway Bldg.
CHICAGO
901 Pacific Bldg.
SAN FRANCISCO

MACHINERY FOR MIXING & KNEADING
MASTICATING, PULPING & SHREDDING
DILUTING, DISSOLVING & DISPERSING
RUBBER WASHING & COMPOUNDING

MAIN OFFICE & WORKS
SAGINAW, MICHIGAN

Maxecon Mill

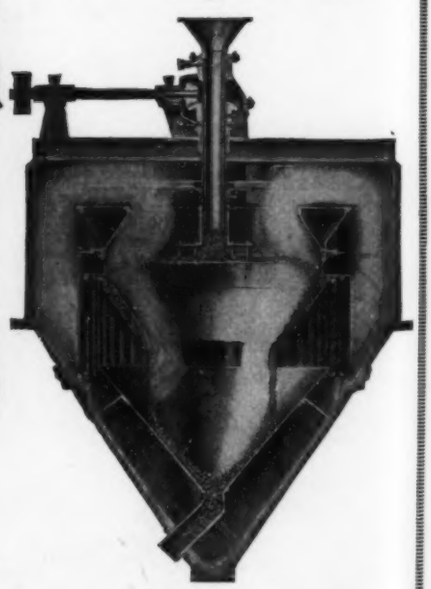


for economical pulverizing

Perfectecon Screen

for coarse screening

American Filter Air Separator



for fine separating

KENT MILL COMPANY

10 Rapelye Street Brooklyn, N.Y.

A Sperry High Pressure Filter Press

Nickel plated plates and frames

PLATE TYPE PRESS can be easily designed to handle a continuous flow of liquid under high pressure.

THIS press was designed for filtering a highly viscous material with an extremely volatile solvent. The general press construction is unusually heavy to stand the high pressure required. It is of the closed discharge type to prevent loss by evaporation and deterioration of the solvent. Besides the ordinary feed a solvent connection has been added.

The Plates in this press are constructed to prevent leakage thru joints due to capillary action. Frames are flush to reduce residual volume to a minimum.

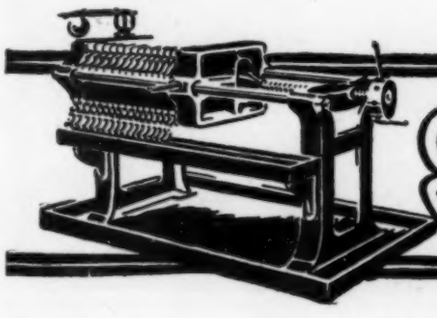
Where the use of nickel plated plates is not permissible we can furnish wood, bronze, rubber, enamel, or bakelite coated cast iron.

We have the experience, product, and engineering facilities for providing the most economical and effective press for your need.

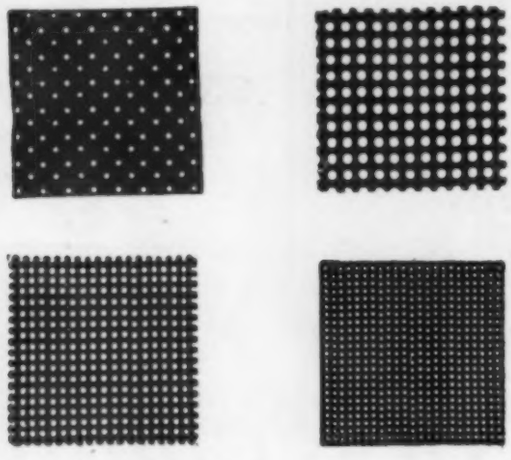
D. R. SPERRY & CO., BATAVIA, ILL.

H. E. Jacoby
95 Liberty Street
New York

B. M. Pilhashy
Merchants Exchange Bldg.
San Francisco, Cal.



SPERRY FILTER PRESSES



the CHEMICAL ENGINEER .... *and* PERFORATED METALS—

Wickwire Spencer Perforated Metals are products resulting from over 50 years' experience in perforating.

The various metal sheets used must pass rigid metallurgical tests, whether they be required for resistance to chemical or abrasive action. The gage of the sheets, the size of the perforations and the spacings are guaranteed to meet most exacting specifications.

For separating, screening or straining dry or liquid materials, the leaders in the industry, who are particular as to results and insistent on service life, insist on Wickwire Spencer Perforated Metals.

Wickwire Spencer can perforate from .025 round hole, (625 per square inch) up to 6 inch round hole, on any centers mechanically feasible. Various shaped holes are also obtainable. We carry a perpetual inventory in stock, including various steels, brasses, copper, bronzes, aluminum, zinc and monel metal, as well as dies that produce over 800 different combinations. Quick shipments are made from large stock of raw materials.

WICKWIRE SPENCER STEEL COMPANY
41 East 42nd Street
New York City

Buffalo *Cleveland* *Chicago* *San Francisco*
Seattle *Los Angeles* *Worcester* *Portland*

PAUL O. ABBÉ

BALL and PEBBLE GRINDING MILLS

and

MIXERS

PAUL O. ABBÉ INC.
245 Center Ave.
Little Falls, New Jersey

MONARCH PERFECTION STONEWARE CHAMBER SPRAYS

are in use in most sulphuric acid plants because—

1. Both nozzle and disc are made of stoneware, and there is therefore little or no wear.
2. Monarch Stoneware Sprays will last almost indefinitely being acid proof and non-erosive — will not break or crack from temperature changes.
3. They can often be cleaned without the necessity of disconnecting.
4. They are absolutely positive in operation, and are so constructed that any and all parts are interchangeable and renewable.

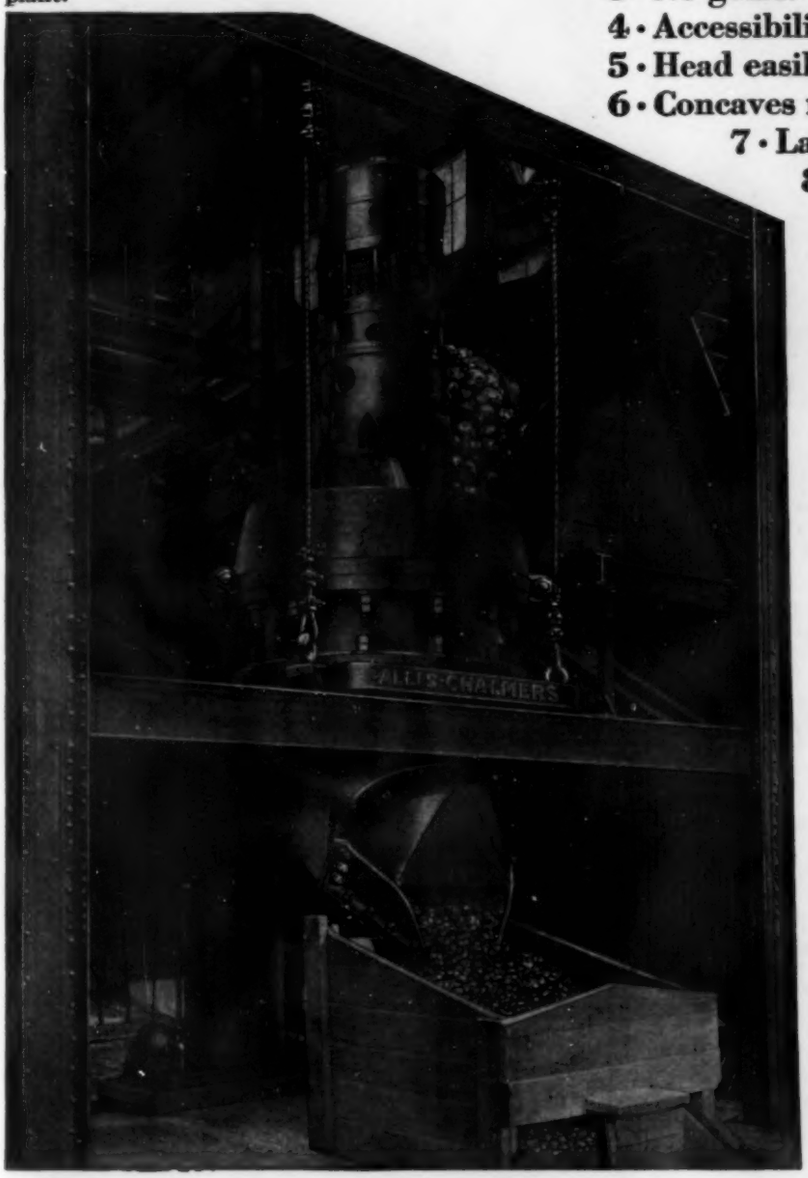
MONARCH MFG. WORKS, INC.
2730 E. Westmoreland Street,
PHILADELPHIA, PA.

the Style "B"

Newhouse Crusher

The crusher that needs *no foundations*

10-inch Style "B" Newhouse Crusher operating in large commercial crushed stone plant.



Ten Outstanding Features:

1 • Crusher suspended by cables.
2 • Motor direct connected.
3 • No gears.
4 • Accessibility of working parts.
5 • Head easily adjustable for wear.
6 • Concaves reversible.
7 • Large unobstructed feed openings.
8 • Maximum size feed compared to receiving openings.
9 • Short, rapid crushing stroke.
10 • Uniformity of finished product.

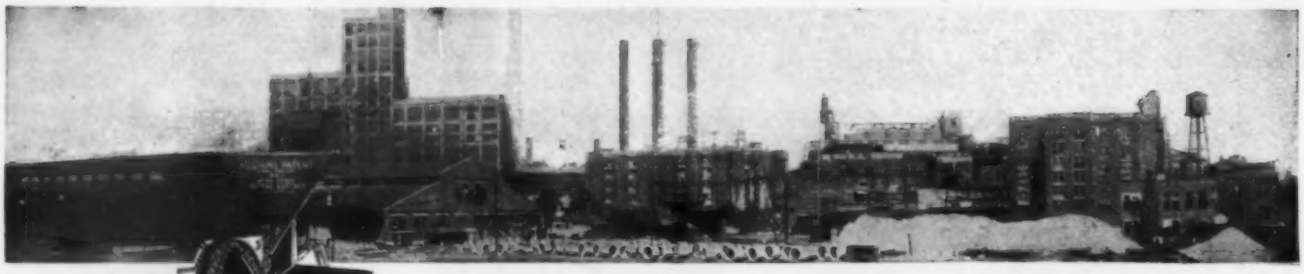
Samples of crusher products have been taken to determine screen analysis under actual operating conditions. One of these is shown below. This sample was taken of the product of a 10″ machine crushing limestone and set at 1½″ open side. The analysis was made on flat testing sieves.

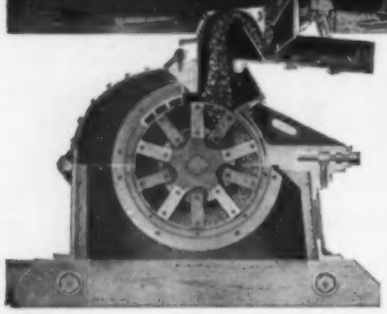
100.0% passing 2¼″ round hole
99.4% passing 2″ round hole
97.6% passing 1¾″ round hole
91.5% passing 1½″ round hole
78.4% passing 1¼″ round hole
63.7% passing 1″ round hole
48.9% passing ¾″ round hole
33.5% passing ½″ round hole
21.8% passing ¼″ round hole
13.4% passing ⅛″ round hole

Write for Style "B" Newhouse Crusher Bulletin 1469

ALLIS-CHALMERS

MILWAUKEE, WIS. U.S.A.





Sectional view of Williams Cereal Grinder, one of several types used by A. E. Staley Co. Note patented metal trap and grinding plate adjustment for taking up wear.

A. E. Staley Co. operating TEN Williams Grinders on Gluten Feed

Occupying 247 acres and grinding 45,000 bushels of corn per day, the huge plant of the A. E. Staley Mfg. Co., Decatur, Ill., is typical of the many big firms which have standardized on Williams crushers, grinders and shredders.

Specializing in the manufacture of corn products, they installed their first Williams grinder more than 20 years ago and since have installed many more, using them on gluten feed, starch, corn oil meal and soya bean cake. They also operate two Williams hammer crushers for preparing coal for their stoker feed boilers. They express themselves as follows: "For our purpose we find Williams grinders not equalled by any other device."

Williams builds 300 types of hammermills, from 50 lbs. to 500 tons per hour capacity. Tell us your problem.

Williams Patent Crusher & Pulverizer Co.
2706 North Ninth St., St. Louis, Mo.

Chicago, 37 W. Van Buren St. — New York, 15 Park Row — San Francisco, 415 5th Street

WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS MO. U.S.A. THE TRADE MARK REG. U.S. PAT. OFF.

Williams

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

WILLIAMS

PATENT CRUSHERS GRINDERS SHREDDERS

Could YOU *filter* COTTAGE CHEESE?

An organic material of the consistency and appearance of cottage cheese, with a tendency of the solid to come out of suspension and float on top of the liquid, is being successfully filtered and thoroughly washed by our

J. & G. HEAVY DUTY VACUUM FILTER

We have solved many other problems equally difficult. We can solve yours. Tell us and let our engineering department show you.

WE BUILD

High Duty Vacuum Rotary Filters	
Vacuum Pressure Filters	Kilns
Evaporators	Stills
Condensers	Driers
Saturators	Towers
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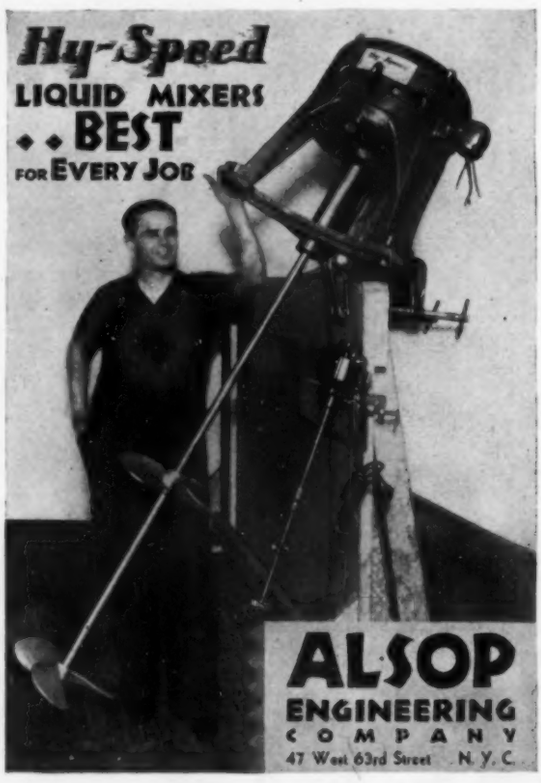
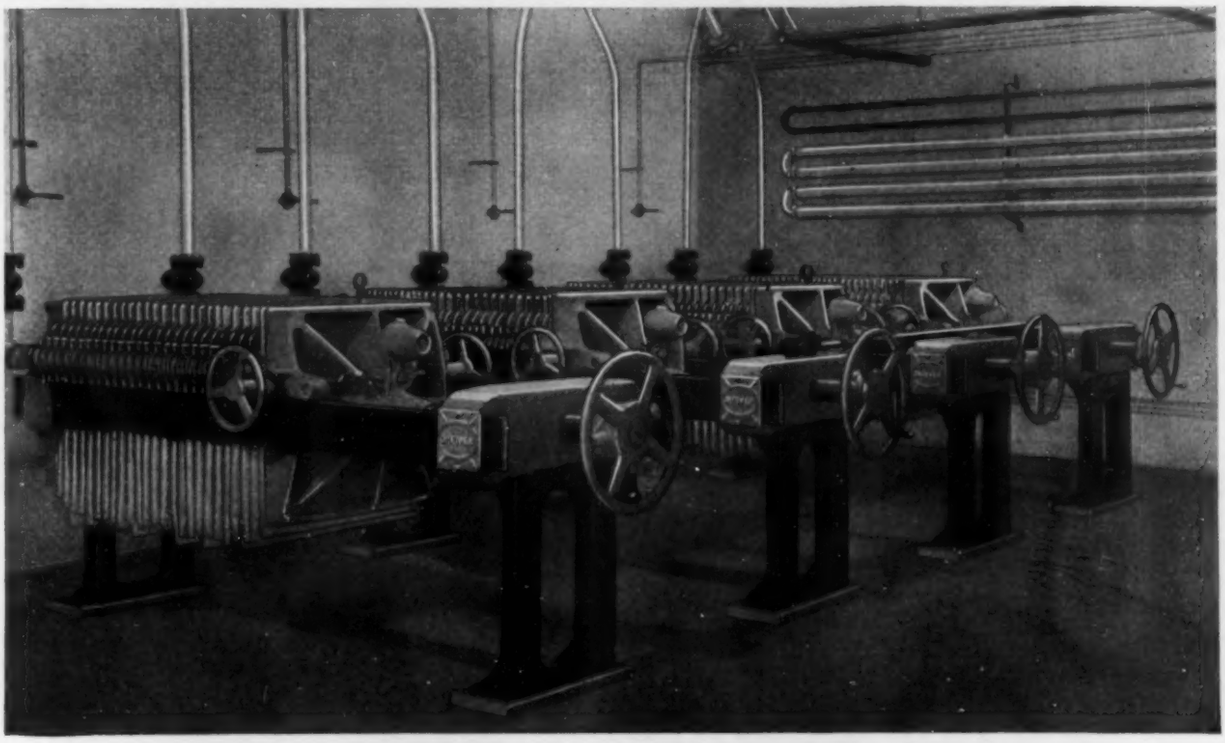
GOSLIN-BIRMINGHAM MFG. CO.

BIRMINGHAM, ALABAMA

New York Office: 82 Beaver Street — *Cable Address:* "JOUGOS"





SHRIVER FILTER PRESSES
IN THE PRODUCTION OF RAYON

In the new, modern plant of the Industrial Rayon Corporation at Covington, Va., Shriver Filter Presses form an integral part of the production equipment.

SHRIVER FILTER PRESSES are used not only by leading Rayon manufacturers but throughout the chemical and chemical process industries Shriver Filter Presses are rendering an efficient service.

Shriver engineers will be glad to consult with you on your filter press operations. No obligation of course. Your inquiries are solicited.

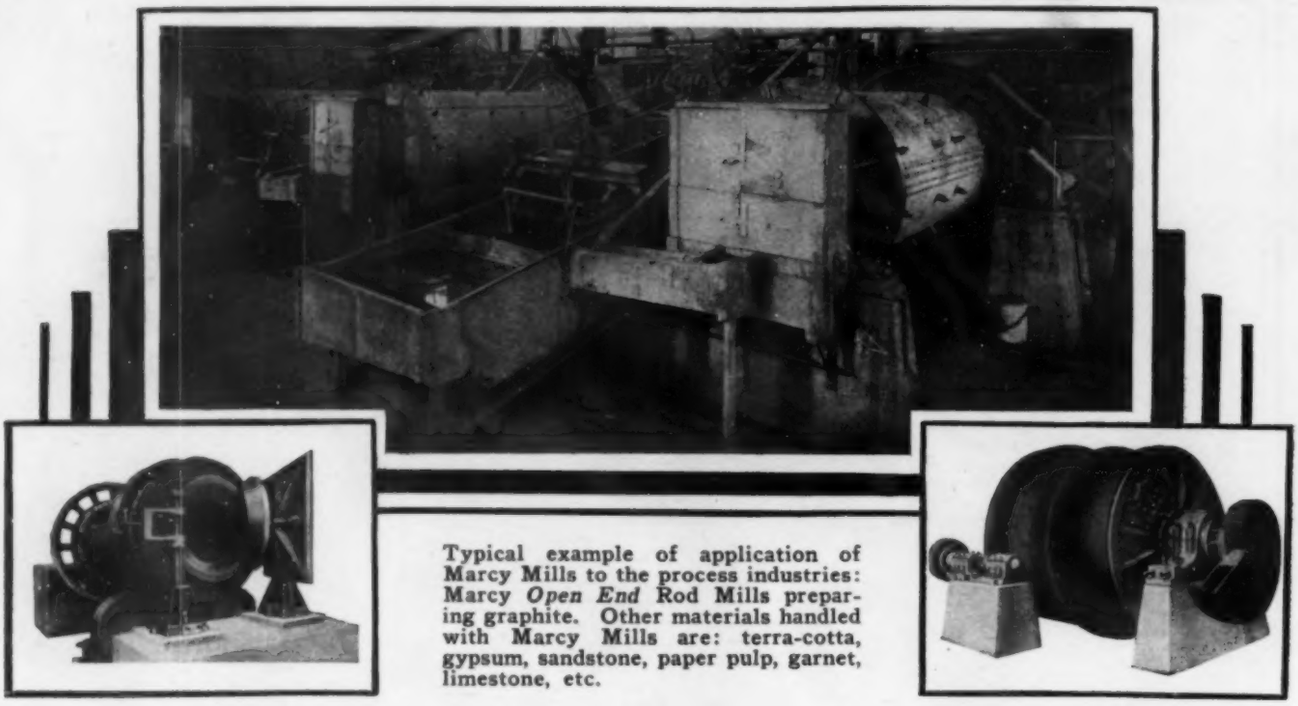
T. SHRIVER & COMPANY
ESTABLISHED 1860
808 HAMILTON STREET
HARRISON · N. J.

A FILTER PRESS FOR EVERY PURPOSE

SHRIVER

T. SHRIVER & CO. FILTER PRESSES HARRISON, N.J.

FILTER PRESSES FILTER CLOTH DIAPHRAGM PUMPS



Typical example of application of Marcy Mills to the process industries: Marcy *Open End* Rod Mills preparing graphite. Other materials handled with Marcy Mills are: terra-cotta, gypsum, sandstone, paper pulp, garnet, limestone, etc.

Headquarters For Grinding Equipment

. . . *medium to heavy duty*

Frequently, in the chemical process industries grinding is an important step—important either in the necessity of having the material properly prepared or in the fact that it forms an appreciable share in the total cost of production.

If either condition prevails in your plant—and if the grinding could be classed as medium to heavy duty—look into the merits of the Marcy Ball Mill and Marcy *Open End* Rod Mill.

Either unit is entirely practical for small as well as large tonnages. Either unit is made in small as well as large sizes. Each is highly regarded not only in the metal mining field but with chemical process industries as well.

Marcy Ball and *Open End* Rod Mills are worthy of your full investigation. In writing, tell us about your grinding problem.

MARCY BALL MILLS
MARCY ROD MILLS
WILFLEY TABLES
WILFLEY PUMPS
FALK GEARS
TELSMITH CRUSHERS

The MINE and SMELTER SUPPLY COMPANY
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MINING MACHINERY
MILL SUPPLIES
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Select the right Filler for your Product

from one of these

14 CELITE MINERAL FILLERS

TO meet the varying requirements of manufacturers who use a filler in their product, Johns-Manville offers fourteen *standardized* grades of Celite Filler. One of these Celite Mineral Fillers may exactly meet the requirements of your product. And here is why—

Each of the Celite Mineral Fillers is of standard, uniform quality, definitely graded as to color, fineness of particle size, and chemical purity to meet different chemical, physical and microscopic specifications. Celite Fillers are obtainable in colors from pure white to deep pink. They range from finely divided powders to granules of pea size. They are mildly abrasive, the degree of abrasiveness increasing with the nature of coarseness of the grade selected. Celite Fillers are highly absorbent of both water and liquids.

Once you have chosen a specific Celite Filler you can count on it for uniform performance as you do on other ingredients in your product. We are ready to cooperate with you to *help you choose* a Celite Filler which will do a better job than the material you are at present using. Use coupon for further information.

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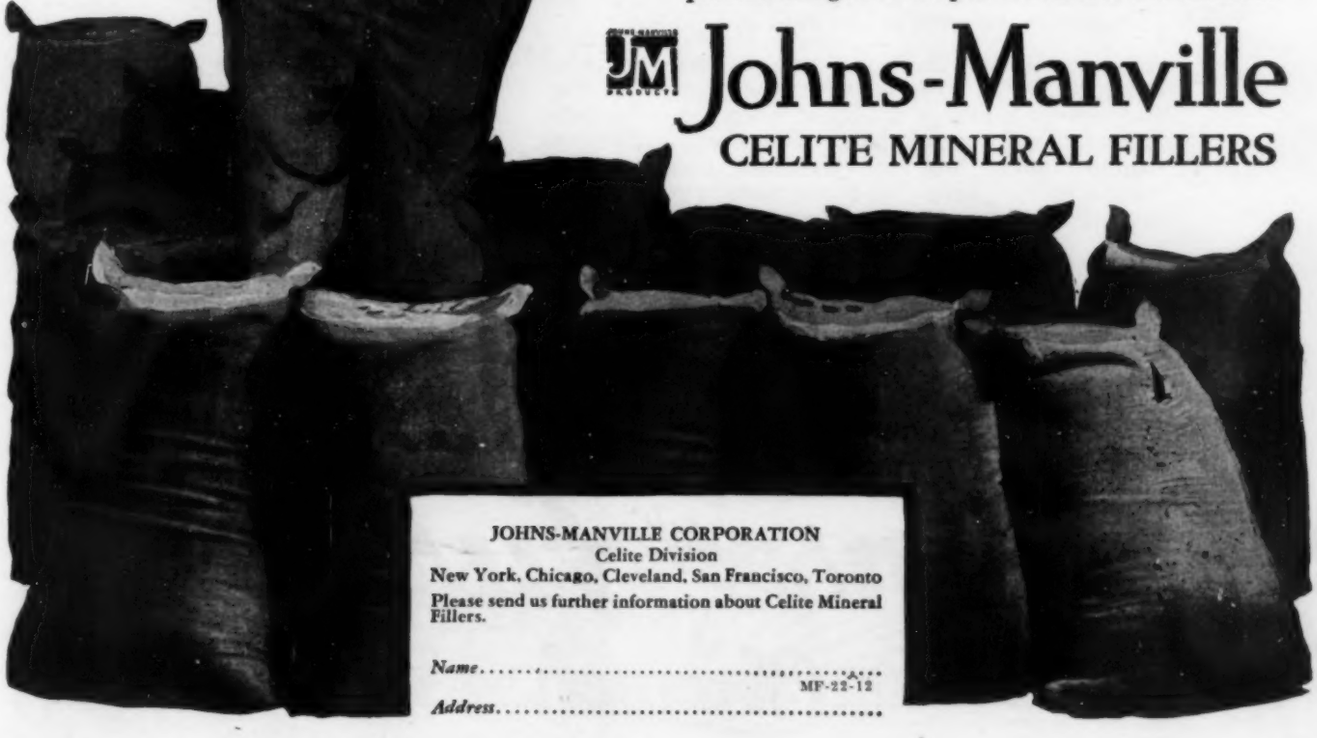
CELITE MINERAL FILLERS



JOHNS-MANVILLE CORPORATION
Celite Division
New York, Chicago, Cleveland, San Francisco, Toronto

Please send us further information about Celite Mineral Fillers.

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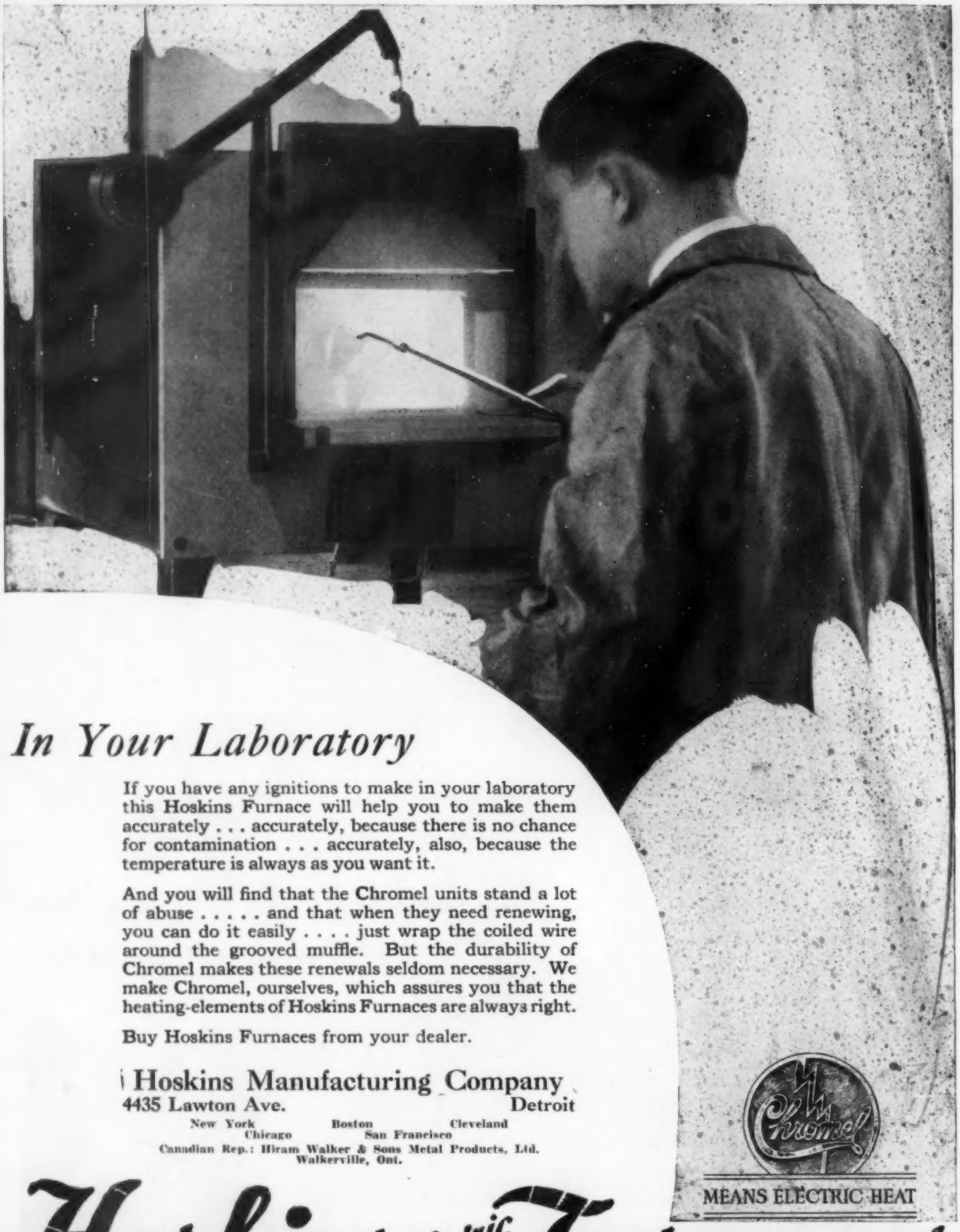
MF-22-12

Address.....



In Your Laboratory

If you have any ignitions to make in your laboratory this Hoskins Furnace will help you to make them accurately . . . accurately, because there is no chance for contamination . . . accurately, also, because the temperature is always as you want it.

And you will find that the Chromel units stand a lot of abuse . . . . . and that when they need renewing, you can do it easily . . . . just wrap the coiled wire around the grooved muffle. But the durability of Chromel makes these renewals seldom necessary. We make Chromel, ourselves, which assures you that the heating-elements of Hoskins Furnaces are always right.

Buy Hoskins Furnaces from your dealer.

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MEANS ELECTRIC HEAT

Hoskins Electric Furnaces

Originators and Manufacturers of Chromel The Alloy that made Electric Heat Possible

It delivers at all times a product of uniform fineness

■

Men in charge of dry grinding plants know the importance of being able to pulverize material to uniform fineness. The Bethlehem Pulverizer is the one machine that delivers at all times a uniformly fine product. That is one reason why more and more plants are being equipped with it.

No amount of wear in the grinding elements can affect the ability of the Bethlehem Pulverizer to turn out a product of unvarying fineness. A system of heavy springs and levers maintains a uniform pressure between the rollers and the table tracks. And regardless of any degree of wear that may have occurred in the grinding elements, the area of contact of the rollers and the table track remains unchanged. As a result, even after many years of service the Bethlehem Pulverizer delivers a product just as uniformly fine as the day it was installed.

It has many other advantages, all of which are fully covered in Catalog J-1. Write for a copy today.

BETHLEHEM STEEL COMPANY

General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago St. Louis, San Francisco, Los Angeles, Seattle, Portland and Honolulu.

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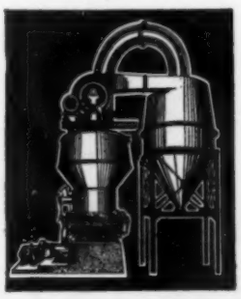
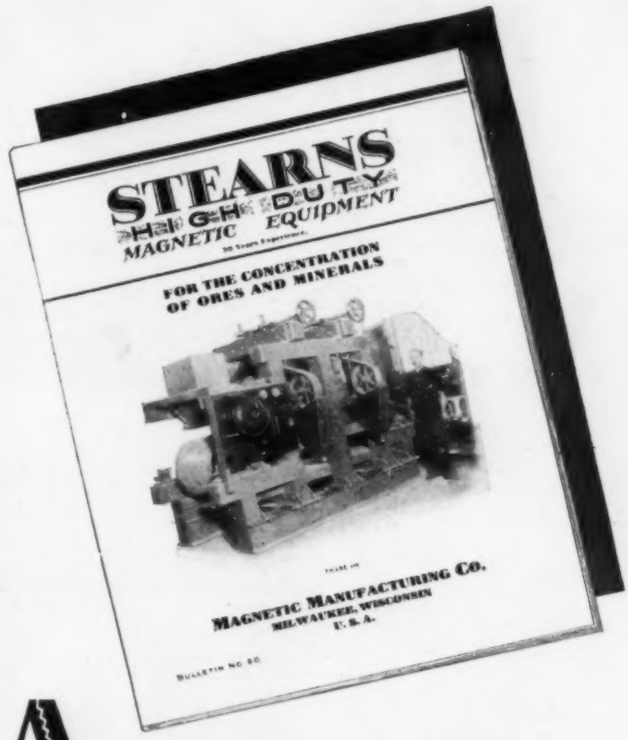
Sole Exporter of our Commercial Products



BETHLEHEM PULVERIZER



A PURCHASING GUIDE...

for Magnetic Separation Equipment

IN THIS latest publication, Bulletin No. 80, the Magnetic Mfg. Company describes the use of Magnetic Separators for the concentration of ores and minerals.

HIGH STEARNS DUTY

Stearns Magnetic Equipment Includes:

- Magnetic Pulleys
- Apron Conveyor Magnets
- Magnetic Separators for Iron, Steel and Brass
- Magnetic Separators for Grain, Coal, Fertilizer and other materials
- Special Magnetic Separators
- Magnetic Drums
- Magnetic Chutes
- Magnetic Clutches

Complete and valuable information is given on the kinds and characteristics of ores and minerals amenable to Magnetic separation, the processes employed, and the type of separators available for a variety of concentration applications. The bulletin is profusely illustrated with plates of representative installations and apparatus.

We are glad to send this bulletin to engineers and executives concerned with the problems of ore and mineral concentration. Use convenient coupon below.

Clip this convenient coupon

Magnetic Mfg. Co., 279 23rd Ave., Milwaukee, Wis.
Please send me Bulletin No. 80, describing Stearns Magnetic Equipment for the concentration of ores and minerals.

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Company .....
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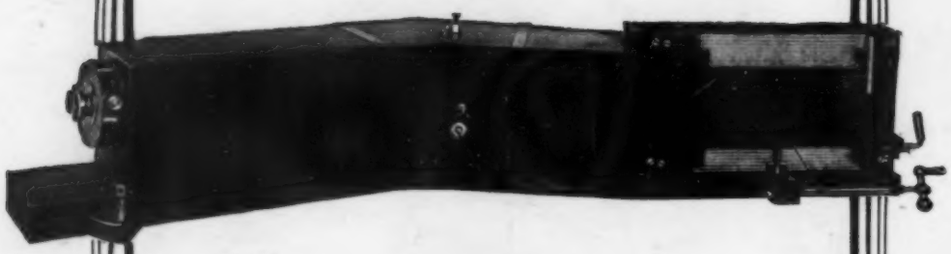


A New
Quartz Spectrograph
with a "cast-iron back-bone"

IT IS of metal throughout. All parts are supported individually on a cast-iron base extending full length of the instrument. This substantial, machined casting forms a "back-bone" and insures permanency and stability to a degree that is given by no other construction. All adjustable parts are fitted with facilities for clamping the units firmly so that permanence of location is assured.

SPECIFICATIONS

General—See description. Also fitted with removable automatic photographic shutter. Finished in dull smooth alcohol-proof enamel.

Optical System—Made of crystalline quartz of the finest quality.

Collimator Lens—Of a single piece of quartz. Focal length 610 mm for 5893 A. Diameter 50 mm.

Camera Lens—A doublet; focal length 610 mm for 5893 A. Diameter 50 mm.

Prism—Of Cornu type, size 65x40 mm. face.

The Slit—Bilateral, with jaws of nonoxidizing material; micrometer drum reading to 0.01 mm slit width.

Plate Holder—Of aluminum casting with metal dark slide and back cover. Movable vertically by hand wheel for multiple exposures.

Wavelength Scale—Graduated from 2100 A to 7000 A, adjustable for internal position. Fitted with lamp and switch for exposure.

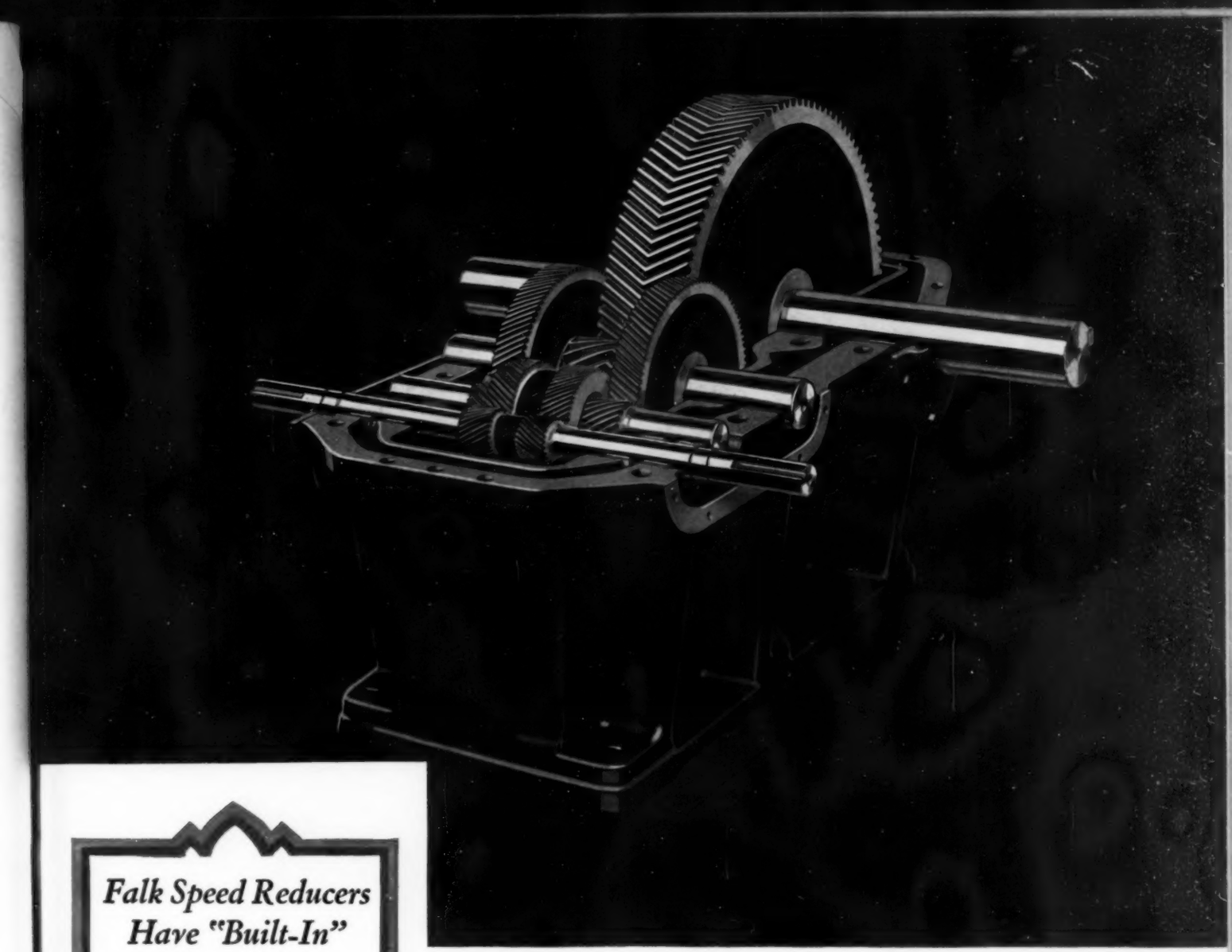
Plate—Standard 10-in. by 4-in.

Catalog No. 2820 ..... net $1,475.00

Write for complete information on this model.

Bausch & Lomb Optical Co.

601 St. Paul St. Rochester, N. Y.



Falk Speed Reducers Have "Built-In" Advantages

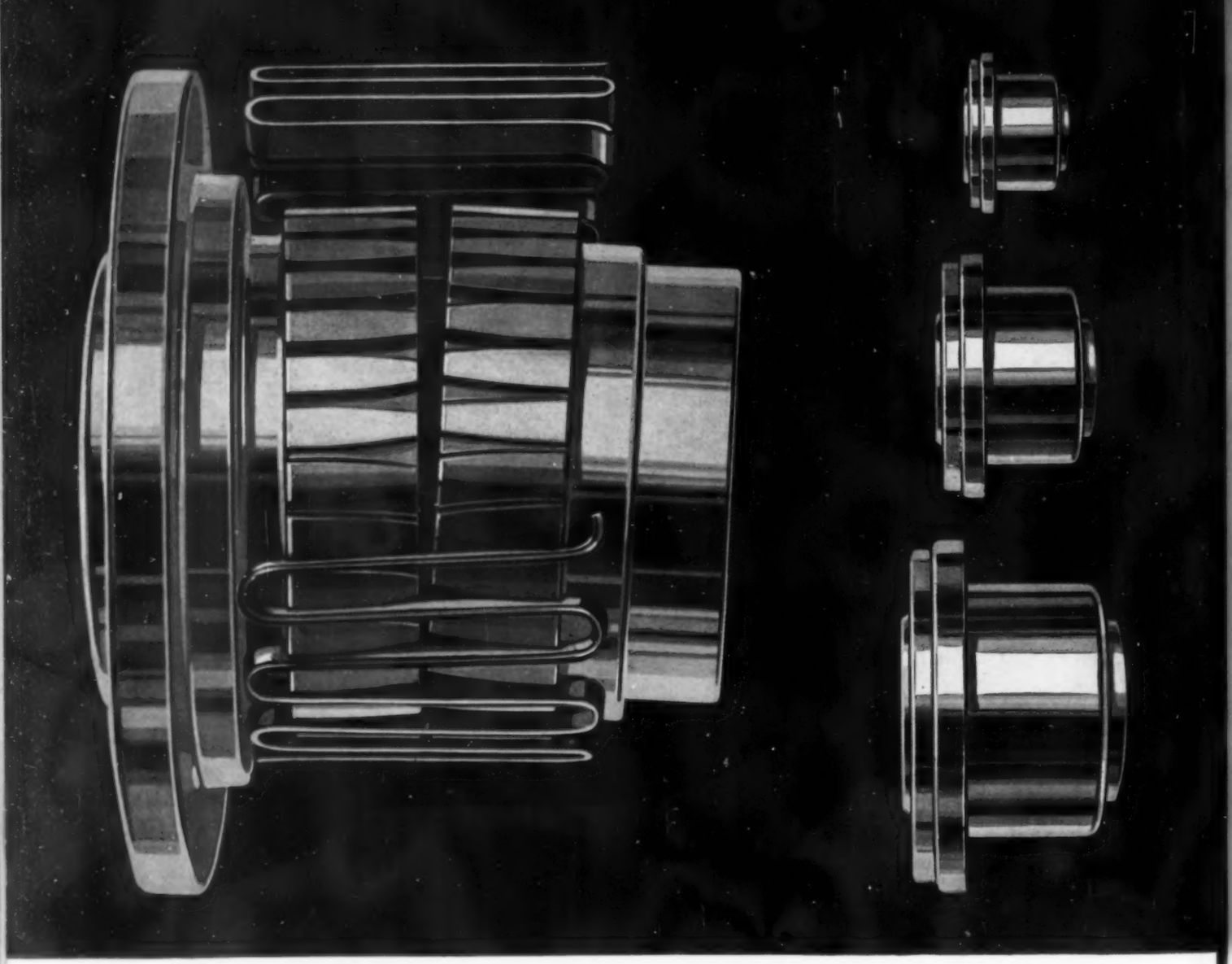
In their construction are found the reasons why Falk Speed Reducers operate quietly — why they are highly efficient . . . Symmetrical arrangement allows equal pressure on bearings and prevents uneven wear and misalignment . . . All wearing parts are interchangeable and renewable . . . Patented splash system of lubrication assures long, uninterrupted service . . . Excessive capacity makes it unnecessary to buy over-size reducers . . . There are no male or female shafts, bushed gears or overhung studs—nothing but plain bearings and live shafts . . . . Naturally the highest possible efficiency is maintained throughout the life of reducers . . . . For practically every kind of service, there is a Falk Herringbone Gear Speed Reducer — made in standard sizes and ratios, and carried in stock for immediate shipment.

Falk Speed Reducers Insure Greater Efficiency — Have 100% Overload Capacity!

The country-wide recognition and acceptance of Falk Herringbone Gear Speed Reducers is an earned one . . . It is the result of efficient, faultless speed reducer service based upon actual performance . . . Falk Speed Reducers incorporate the famous Falk Herringbone Gears, designed to deliver 96% to 98½% of the power at full load . . . They have 100% overload capacity for starting and during intermittent periods . . . Simple, compact in design, Falk Speed Reducers are oil-tight, dirt-proof, noiseless, free from heat and vibration . . . They permit a higher ratio of reduction per gear, transmit the load and transform speed with less friction loss than any other type . . . Standard sizes carried in stock at competitive prices . . . Send for a Speed Reducer Bulletin.

FALK

SPEED REDUCERS



Falk Flexible Couplings are Positive in Action

. . . Effectively Absorb Shock and Vibration!

In the distribution of power, the function of the Flexible Coupling is paramount . . . It must allow for both angular and parallel misalignment which commonly arise in operation . . . It must absorb shocks . . . It must be dependable . . . It must be all-metal, amply lubricated . . . It must be both torsionly and laterally resilient . . . The Falk Flexible Coupling meets all of these requirements with a margin to spare . . . It provides free end float at all loads . . . It embodies a patented principle that makes for exceptional resiliency with ample strength and ease of installation . . . Falk Flexible Couplings are standardized from 1/5 H. P. to 20,000 H. P. at 100 R. P. M . . . Send for our Coupling Bulletin No. 180.

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What Falk Flexible Couplings Do!

Allow both lateral and torsional elasticity . . . Are easily connected and disconnected . . . Are all-steel . . . Provide widest distribution of pressure . . . Allow most correct lubrication . . . Float freely under load . . . Insure greatest resistance to overloads . . . Absorb shock and vibration . . . Accommodate parallel and angular misalignment. . . . Can be lined up quickly without special tools . . . Cannot rust — springs are packed in grease . . . Have no unreliable elements, which lead to breakdowns . . . Operate equally well in both directions; either end can be the driver.

Other Falk Products—Gears, Speed Reducers, Oil Engines and Steel Castings

FALK

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BRAUN
Electrolytic Cabinets

Will simplify and speed up your electrolytic determinations.

Used by many firms, both large and small, who use copper, lead and other metallics in the manufacturing of their products. Some of these firms have had the same Cabinets in constant operation for over 15 years.

These Cabinets are substantially built—service being the first consideration—monel metal is used for chucks or anode holders. For protection from acid fumes the ammeter, switches and operating parts are enclosed in the Cabinet.

Made in three sizes: 2, 4 and 6 units. Each unit arranged for stationary cathodes and revolving anodes.

Write us for more details—we will gladly send you descriptive literature.

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Braun Laboratory Appliances Standard the world over!

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ACID-PROOF SINKS

U. S. STANDARD Chemical Stoneware Sinks are widely used in chemistry and bacteriological laboratories of universities, schools, hospitals and industrial companies. These Sinks offer the following overwhelming advantages:

1. They are ONE-PIECE construction, without seams or interlocking joints: thus permanently leak-proof and trouble-proof.
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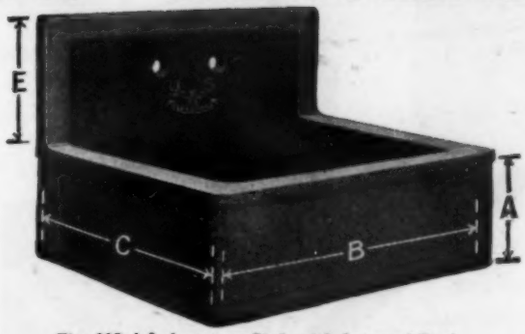

Fig. 112-A Laboratory Sink with Integral Back

Number	B	C	A	E	Code Word	List Price F.O.B. Akron, O.	
						Plain Without Back	With Integral Back
710	20	12	7	10	TALLY	$21.00	$25.00
712	20	16	7	10	TAUNT	22.00	26.25
713	24	15	8	10	TENOR	24.50	28.75
714	32	16	7	10	TERSE	32.00	37.00
715	30	20	8	10	THUMB	38.00	44.00
716	36	18	7	10	TIGER	41.00	47.00
717	42	20	12	10	TOAST	72.00	80.00

Above prices are for Sinks with plain countersunk outlets.
List prices subject to discount.

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Works (Since 1865) **Akron, Ohio**

NEW YORK OFFICE: 50 CHURCH STREET

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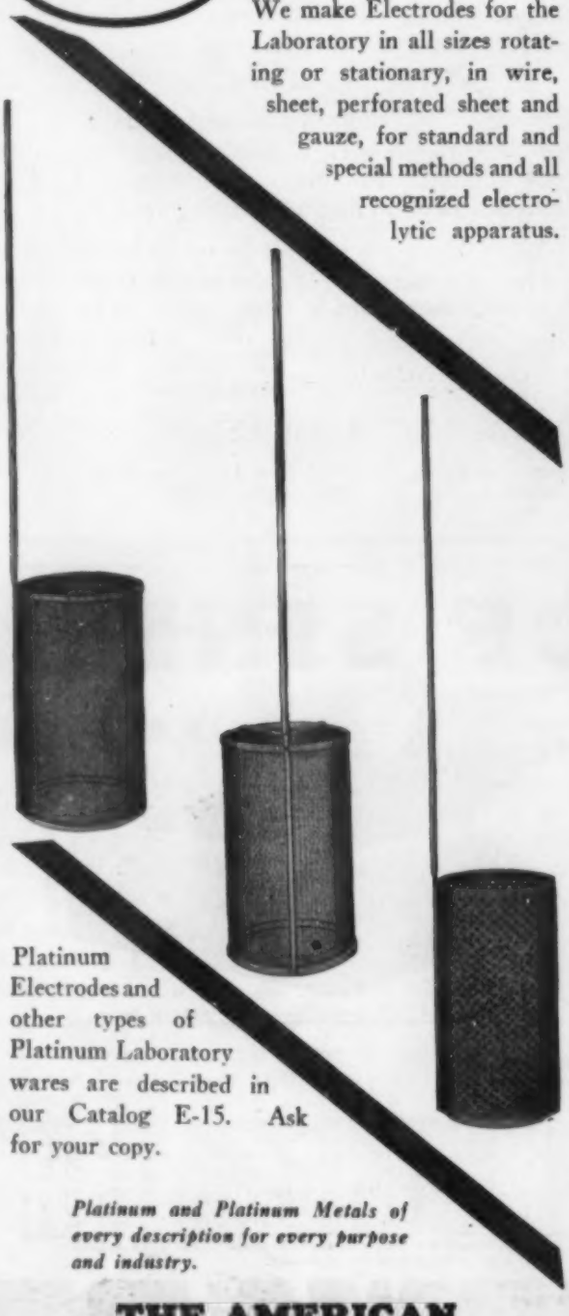
PLATINUM ELECTRODES

for continuous accurate performance

We make Electrodes for the Laboratory in all sizes rotating or stationary, in wire, sheet, perforated sheet and gauze, for standard and special methods and all recognized electrolytic apparatus.



Platinum Electrodes and other types of Platinum Laboratory wares are described in our Catalog E-15. Ask for your copy.

Platinum and Platinum Metals of every description for every purpose and industry.

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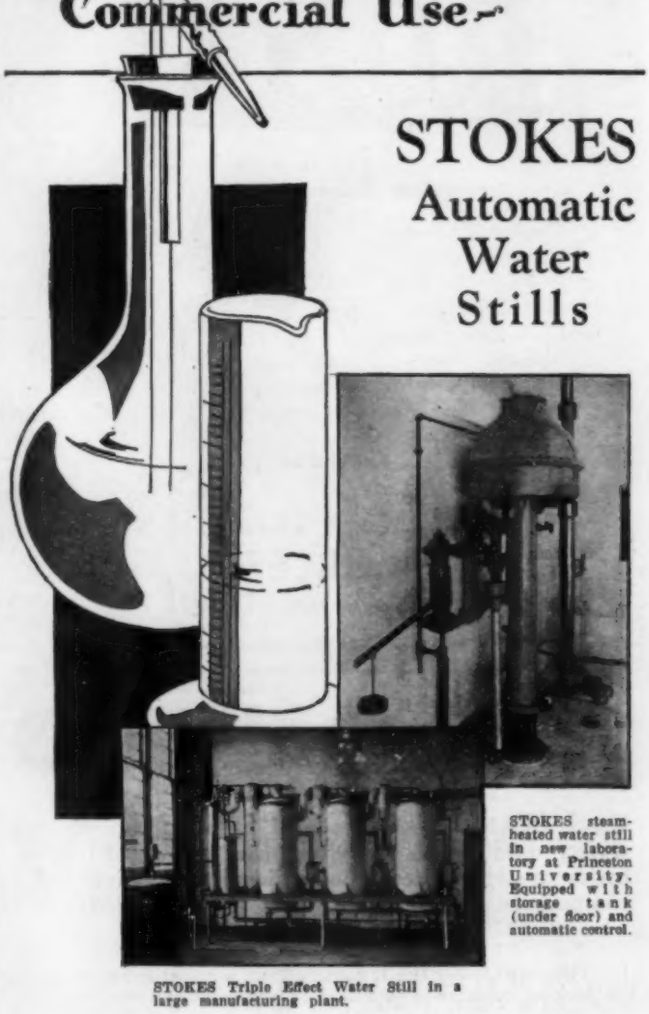
N. J. R.R. AVE., AT OLIVER ST.

NEWARK, N. J.

Distilled Water for every Laboratory and Commercial Use

STOKES Automatic Water Stills



STOKES steam-heated water still in new laboratory at Princeton University. Equipped with storage tank (under floor) and automatic control.

STOKES Triple Effect Water Still in a large manufacturing plant.

Sizes available from ½ gallon per hour—laboratory size up to **5,000 per hour or more** for commercial use. Our multiple effect stills produce large quantities at lowest cost. Write for special folder on water stills.

We are in Chemical Engineering Catalog

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Studying "star dust" with a PYREX Reflector

Frame for the reflecting telescope at the University of Kansas

THE new reflecting telescope which the University of Kansas is now erecting will contain a 27-in. PYREX reflector, 4 in. thick.

The production of this reflector presented some unusual and knotty problems. Yet they were no more difficult than hundreds of others which Corning Glass Works laboratories and engineers are constantly called upon to solve. Each day's mail brings requests for novel forms of PYREX Ware. Not always successful, Corning engineers have nonetheless reached a high degree of skill in the fabrication of industrial glass products formerly made of other materials.

Nearly every industry is utilizing the unique combination of characteristics which PYREX Ware affords! Transparency, immunity to chemical corrosion, hardness, resistance to heat shocks, electrical insulation.

You can send in your inquiry with full confidence that if the characteristics of PYREX Ware can be engineered into your product economically, Corning Glass Works can do it.

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New Book Shows Complete Kewaunee Line—Write for It

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All these Cabinets and Cases are standard Kewaunee pieces and are offered at very reasonable prices. If your laboratory is in need of a new cabinet, write for the Kewaunee Book at once. It will be sent to you free and postpaid.

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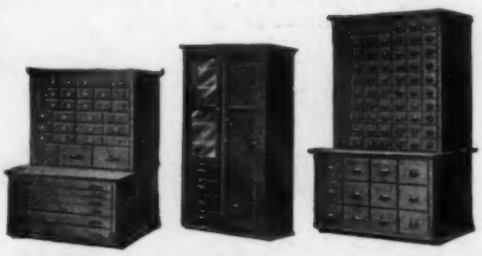
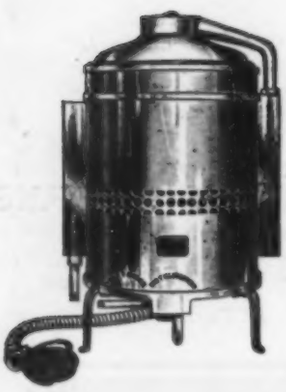


No. G-1323 Laboratory Storage and Filing Cabinet
No. G-1431 Wardrobe and Book Case
No. G-1330 Stock and Preparation Room Case

Precision Automatic Water Stills

for Gas, Steam, or Electricity



These stills embody the most advanced ideas in still construction to avoid the difficulties inherent to other stills.

The water is automatically controlled, irrespective of the changes of pressure, as long as the water is running.

As there are no pipes in the condenser and the entire top of the still is removable, the crust can be more easily removed than in any other still, the entire interior being exposed and not a small hand opening only.

Electric units will not burn out immediately should the still run dry.

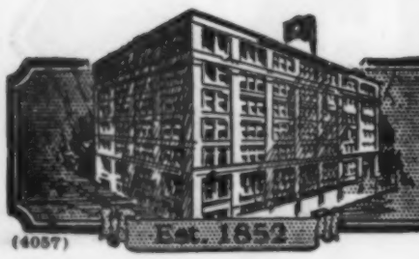
The distilled water is delivered cold.

Overflow is taken from the cold and not from the hot water, thus conserving heat.

These stills are made to stand on a table or to hang on the wall, or, if desired, may be superimposed on a block tin lined storage tank forming a very concentrated and desirable installation.

A one-gallon electric still consumes 2500 watts. The coil of the steam still is of copper, block tin coated and is guaranteed up to a pressure of 250 pounds, requiring no pressure reducing valves.

Circulars, prices and full information on application.
When ordering, please state voltage.



E. H. SARGENT & CO.
155-165 East Superior Street · · · CHICAGO, ILL.
LABORATORY SUPPLIES

(4057)

Platinum-Rhodium Gauze DB-750 for Ammonia Oxidation

The Longer Lived, More Efficient Catalyst

FIGURES compiled through observation and comparison in ammonia oxidation plants, that have used pure platinum and DB-750 platinum-rhodium gauze catalysts, in the manufacture of nitric acid, prove DB-750 to be not only more efficient as a catalyst but to have a longer life of usefulness too. Tabulated, the findings show the new gauze to have:

An efficiency of from 2 to 4 per cent greater than pure platinum
Up to 60 per cent Longer Life — **Lower Crystallization Rate**
Greater Mechanical Strength — **Lower Vaporization Rate**
Lower specific gravity (about 93.3 per cent of that of pure platinum)

With its higher performance and longer life, the economy of the new catalyst becomes apparent. The figures quoted are not based upon theory, but are the actual results obtained in nitric acid plants where DB-750 has displaced pure platinum.

In the modern chemical works as in all modern industry, Efficiency—Performance—Economy are the gauges used to measure the fitness of equipment. DB-750 so far surpasses pure platinum for gauze catalysts on the three counts that it has all but completely displaced it in American plants. Abroad, its progress is a repetition of its history here. Patents have been granted for it in this country and have either been allowed or are pending all over the world.

We shall be happy to go into details with you

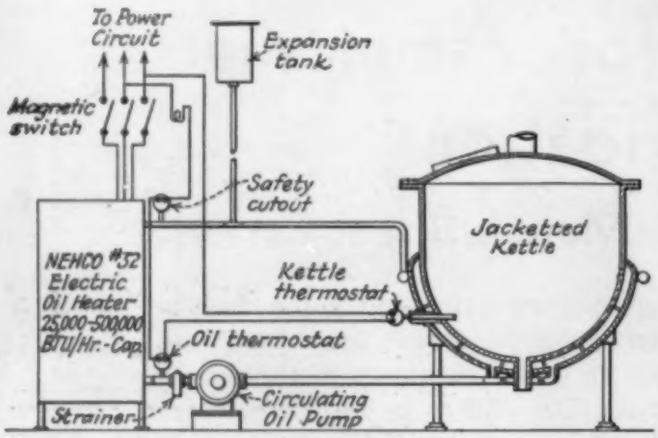
BAKER & CO., INC.

54 AUSTIN ST. NEWARK, N. J.

NEW YORK SAN FRANCISCO CHICAGO

NEHCO PROCESS

Industrial and Process Heating by Circulating Oil 300 to 800° F. Without Fire or Danger



97% CONVERSION of ELECTRIC POWER to process HEAT in the KETTLE JACKET.

Low initial, operating and maintenance cost—no pressure, fire or danger.

Speed up production—reduce operating cost—improve quality and uniformity by the use of higher temperatures under close automatic control.

Converts your present jacketed equipment to high speed electric operation at any desired temperature and BTU input.

Process heat by wire—always available in any quantity—quick starting—no standby losses.

Send for Bulletin C-85

NATIONAL ELECTRIC HEATING CO.

86 34th Street, Brooklyn, N. Y.

Room in new Chemical Laboratory, Princeton University

All surfaces exposed to corrosive acids (table-tops, fume-hoods, sinks, shelving, etc.) in the new million and a half dollar Chemical Laboratory at Princeton University are of Alberene Stone.

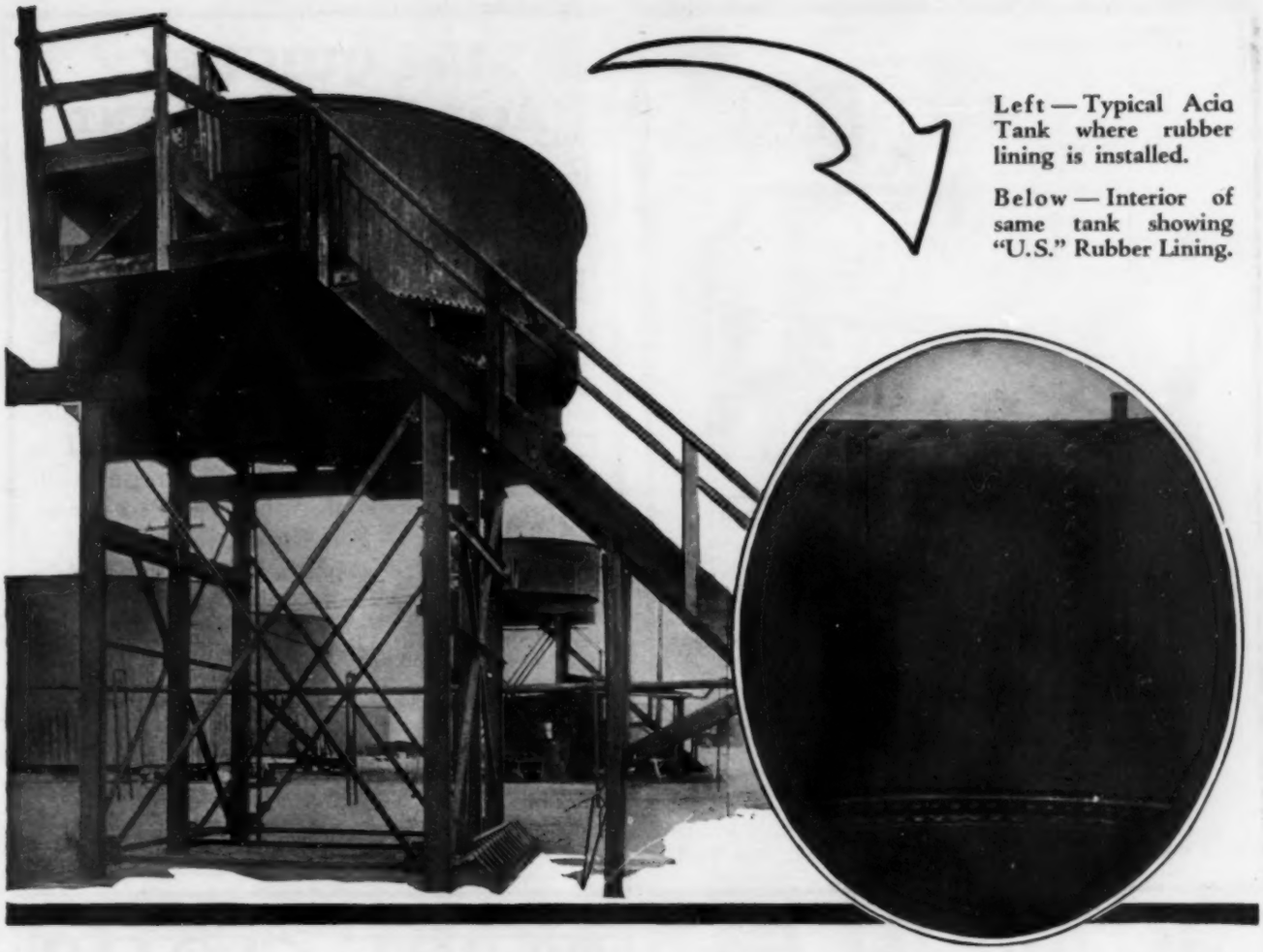
Thus, the latest and most modern laboratory is insured against costly repairs and depreciation.

Inherently, Alberene Stone is practically acid and moisture-proof, and highly resistant to stain and flames. Joints, tongued and grooved and cemented with acid-proof cement, are permanently gas and air tight.

We are glad to add the new Chemical Laboratory of Princeton University to the already imposing list of important laboratories which are equipped with Alberene Stone.

Alberene Stone Company, 153 West 23rd St., New York City. Quarries and Mills at Schuyler, Va.

ALBERENE STONE ***(A product of the State of Virginia) Standard for all laboratory working surfaces.***



Left — Typical Acid Tank where rubber lining is installed.

Below — Interior of same tank showing "U.S." Rubber Lining.

Protect Your Acid Tanks

—with "U. S." Rubber Linings!

Rubber is a natural resistant to most acids.

"U. S." New Process Rubber Linings are a practical and economical solution to the handling of acids and corrosive materials. This lining can be applied to large or small tanks of all kinds, shipping drums, buckets, plating equipment, etc.

Here is a rubber lining that is *soft* and flexible, yet tough and wear resisting. Experience has proven that *soft*, flexible rubber linings are preferable to the harder rubber compounds since they expand and contract with the metal surfaces without cracking and resist external impacts without chipping.

"U. S." Rubber Linings are permanently fastened to either wood or metal surfaces and are vulcanized into *one* piece.

May we send you further information about "U. S." Soft Rubber Linings?

We manufacture a complete line of Mechanical Rubber Goods for the Chemical Industries including Belting, Packing, Hose and Hard Rubber Products. Let us send you our Catalog.

United States Rubber Company

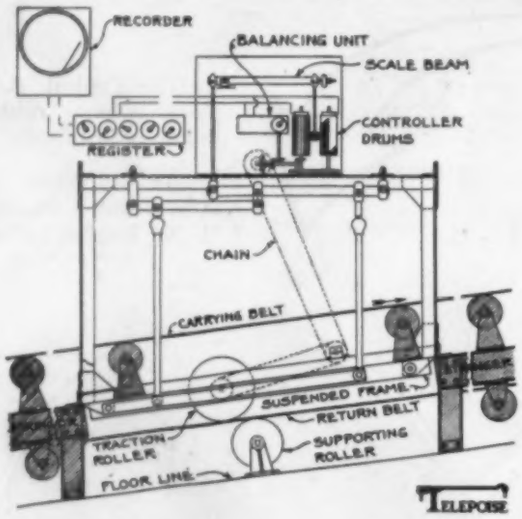
TRADE MARK

1790 Broadway, New York City

Branches in every industrial center

"U.S." Rubber Linings

Prevent corrosion of wood and metal surfaces



Telepoise . . .

A Better Conveyor Scale

Simple, easy to install, and permanently accurate. No lubrication or other maintenance expense.

Indicates, Registers and *Records* the true weight of the material conveyed. Write for catalogue.

Sold at a price that leaves no justification for operating a conveyor without exact knowledge of its performance.

WRITE FOR INFORMATION

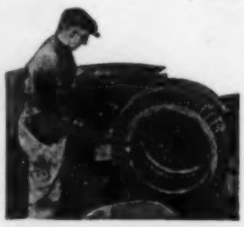
John Chatillon & Sons

E. J. White, *Sales Agent* 85 Cliff St., New York

Use QUIGLEY ACID-PROOF CEMENT

For Acid-Proof Masonry —Towers—Chimneys— Tanks—Vats—Chutes, Etc.

It saves the laborious and uncertain compounding that is required in the case of dry cements where lack of thorough mixing or incorrect proportions of ingredients will often cause failure of the joints or a poor job. QUIGLEY ACID-PROOF CEMENT is a smooth and uniform plastic preparation shipped ready to use in airtight containers.



It sets up hard and forms a strong bond at ordinary atmospheric temperature. It resists strong, weak, and mixed solutions of sulphuric, nitric, hydrochloric, phosphoric and other corrosive acids.

Ask for test sample and Booklet A 117 C

QUIGLEY FURNACE SPECIALTIES COMPANY INCORPORATED

56 West 45th Street New York

REFRACTORY MATERIALS FOR FURNACE CONSTRUCTION AND MAINTENANCE
ACID PROOF CEMENTS ACID AND ALKALI PROOF COATINGS

Stock and Service through Agents in Every Industrial Center

For Silverplating

SILVER NITRATE

MERCK

U.S.P., C.P.

Especially adapted to the requirements of the engraver.

SILVER CHLORIDE
and other Silver Salts

GOLD CHLORIDE
GOLD CYANIDE
and other Gold Salts

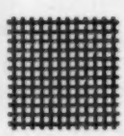
MERCK & CO. INC.

MANUFACTURING CHEMISTS

SUCCESSORS TO
POWERS-WEIGHTMAN-ROSENGARTEN CO.

New York RAHWAY, N. J. St. Louis
Philadelphia Montreal

WIRE CLOTH AND WIRE WORK



Whatever your wire cloth needs, we can fulfill them promptly with a quality cloth of any design, mesh, gauge or material. All "Buffalo" wire cloths are accurately woven on our own improved power looms. Galvanizing at your option, either before or after weaving in our own galvanizing plant.

Buffalo WIRE
A BETTER WIRE CLOTH

We also build all descriptions of wire work—baskets, screens, safety guards, filters, etc. All wire work is durably constructed for long service by a corps of skilled craftsmen. Send specifications and we will gladly quote prices.

Buffalo Wire Works Co., Inc.
(Formerly Scheeler's Sons, Est. 1869)
482 Terrace, Buffalo, N. Y.

Accurate Sampling

Two years' tests in actual operation at various flotation plants demonstrate the great advantages of—

GEARY-JENNINGS SAMPLER

Nine Points of Superiority

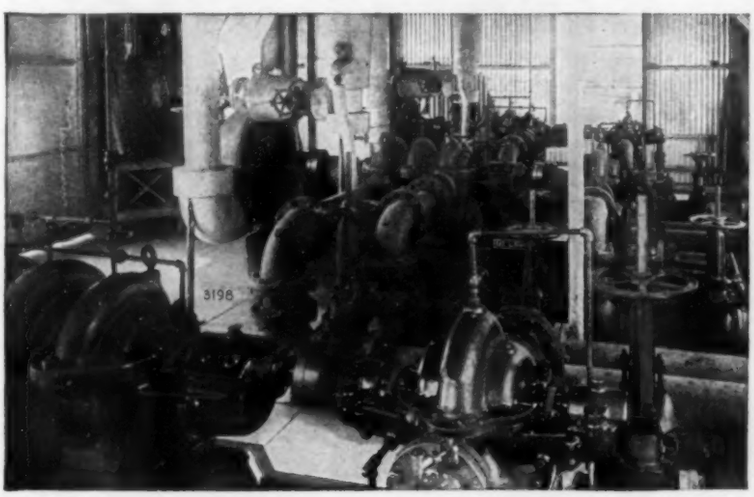
1. CORRECT SAMPLING REQUIREMENTS ARE COMPLETELY FULFILLED by the Geary-Jennings Sampler. (a) The mechanism operates at regular time intervals, the duration of which may be quickly and easily varied to suit demands. (b) The cutter does not swing in an arc but moves across the pulp stream in a straight line and (c) at a uniform rate of speed.
2. A DUST - PROOF, MOISTURE - PROOF HOUSING encloses the entire mechanism.
3. TAMPERING WITH THE SAMPLER IS IMPOSSIBLE. The housing is arranged to be padlocked in place, rendering all parts of the machine inaccessible to unauthorized persons.
4. LUBRICATION IS REQUIRED NOT OFTENER THAN ONCE EVERY TWO OR THREE MONTHS.
5. THE SAMPLING INTERVAL MAY BE VARIED TO SUIT REQUIREMENTS. A pointer and dial on the adjustable timing switch permits variation of sampling period to any interval between two seconds and thirty-six minutes.
6. ANY NUMBER OF SAMPLERS MAY BE OPERATED SIMULTANEOUSLY by a master timing switch, which may be located under one of the sampler housings or outside the housing in any location desired.
7. ELECTRICAL EQUIPMENT IS STANDARD thruout the machine. No special devices are used.
8. HEADROOM AND SPACE REQUIREMENTS ARE SMALL.
9. THE GEARY-JENNINGS SAMPLER IS BUILT TO LAST and give service at minimum cost over a long period of time. There are no cams or delicate wearing parts. Sturdiness is built into the machine.

We manufacture Geary-Jennings Sampler, Geary Reagent Feeder, Geary Lime Feeder and Galigher Automatic Sampler. Bulletins on request.

The GALIGHER COMPANY

Salt Lake City Utah

TURBINES and PUMPS



for High Temperatures

IN De Laval steam turbines the high pressure, high temperature steam is confined to the valve body and steam chest, at the top of the casing cover, located above and removed from the bearings, which therefore do not require water cooling.

Where required for pumping hot liquids, the pumps are equipped with heat-treated, alloy steel shaft sleeves, extra deep packing boxes with metal packing and other special features.

Above—Three De Laval turbine driven pumping units in an oil refinery. The turbines develop 150 hp. each at 2600 r.p.m., receiving steam at 140 lbs. and exhausting against 30 lbs. back pressure. The three stage pumps deliver 500 gal. per min. each of .75 specific gravity lean oil at 300° F. against 240 lbs. per sq. in., while the single stage pumps deliver 540 gal. per min. each of .80 specific gravity rich oil at 100° F. against 85 lbs.

De Laval Steam Turbine Company

Trenton. New Jersey

Local Offices: Atlanta, Boston, Charlotte, Chicago, Cleveland, Duluth, Havana, Helena, Honolulu, Houston, Kansas City, Los Angeles, Montreal, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., St. Paul, Salt Lake City, San Francisco, Seattle, Spokane, Toronto, Vancouver.

Manufacturers of Steam Turbines, Centrifugal Pumps, Centrifugal Blowers and Compressors, Flexible Couplings, Double Helical Speed Reducing Gears, Worm Gears, Hydraulic Turbines and Special Centrifugal Machinery.

3047

High Alumina - - - Content in GEORGIA REFRACTORY CLAYS!

(from 35 to 55 per cent)

THE higher temperatures required in industry today, demand refractory products that can stand up to greater heats and loads without spalling.

The use of Georgia Refractory Clays enables you to obtain these desirable qualities in your refractory products, as a result of their unusually high alumina content. Of twenty-four samples of Georgia Refractory Clays tested by the U. S. Bureau of Mines, all deformed above cone thirty-three and some as high as cone thirty-nine.

Extensive deposits of refractory clays are available in the Georgia Clay Belt. Refractory products manufacturers who locate at this raw material source, are also ideally located to serve the present 14 million dollar refractory product market of the South as well as the important markets of the Atlantic Seaboard, Cuba, Mexico, and Central and South America—at a saving of approximately 40 per cent in material assemblage and distribution costs over locations in Northern Ceramic Centers. *Investigate!*

WRITE for This FREE Volume.

An extensive survey of the clay deposits of Georgia and Bulletin of the U. S. Bureau of Mines, giving results of research and plant tests, mailed on request.

The Georgia Geological Survey (Atlanta) has just issued Bulletin No. 44 "Sedimentary Kaolins of the Coastal Plain of Georgia." Copies can be obtained from the State Geologist.

Central *of* Georgia Railway

J. M. Mallory, General Industrial Agent

413 West Liberty St. *Savannah, Ga.*

CENTRAL OF GEORGIA

WELDED CONSTRUCTION

WELDING of Chrome Iron, Stainless Steel for nitric acid resisting equipment. Aluminum, nickel and monel equipment with welded construction. Homogeneous lead linings and chemical lead burning.

NIAGARA BLOWER COMPANY

673 Ontario St. Buffalo, N. Y.

New York Office: 95 Liberty Street

Also manufacturers of Air Engineering Products and Systems for chemical process industries

D E C E M B E R

23

First advertising forms for the JANUARY issue will close Monday, December 23. . . . We will appreciate your usual good cooperation in meeting that closing date. . . . ***Chemical and Metallurgical Engineering.***

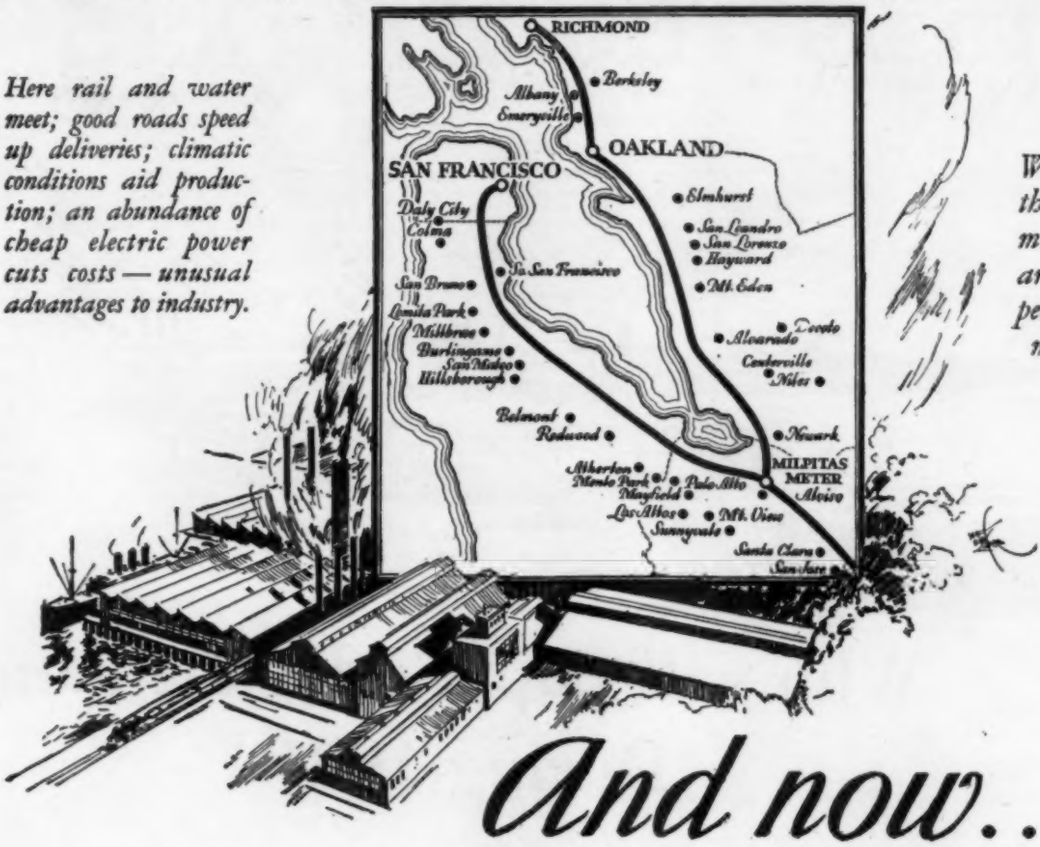
23

D E C E M B E R

INDUSTRIAL PLANT SITES

INVESTIGATE WHY OTHERS LOCATE HERE

Here rail and water meet; good roads speed up deliveries; climatic conditions aid production; an abundance of cheap electric power cuts costs — unusual advantages to industry.



Within 40 miles of the San Francisco metropolitan bay area live 1,600,000 people—the largest market on the Pacific Coast.

And now.....

a supply of NATURAL GAS *to the San Francisco Bay area*

Natural gas is now available for industries in the San Francisco metropolitan bay area. The supply is available from the Buttonwillow and Kettleman Hills gas fields, said by eminent geologists to be the greatest gas fields in the world, capable of delivering 400,000,000 cubic feet of gas per day for a period of 75 years.

And now the San Francisco metropolitan bay area, in addition to its many other attractive inducements for industrial development, offers this new fuel of over 1100 British Thermal Unit Content at particularly low rates.

This Company will place industrial engineers at your disposal. Facts applied to your specific plant will be presented promptly and confidentially to your executives.

SEND FOR A COPY OF
"OUTSTANDING FEATURES OF THE P. G. AND E."

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·

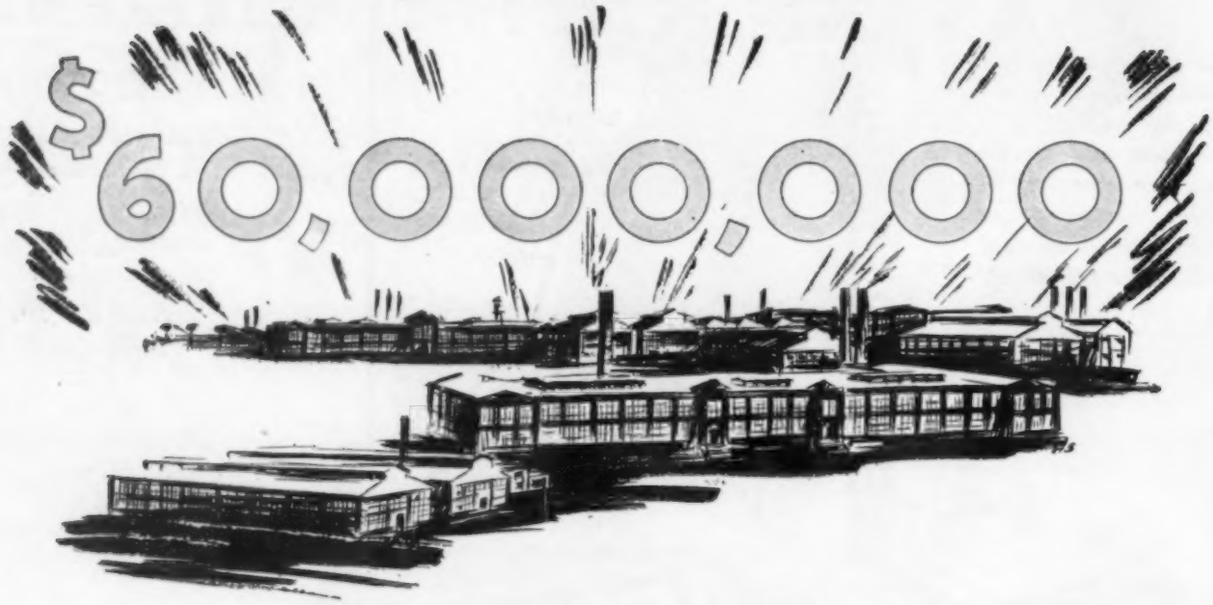
Serving 349 communities in Northern and Central California

General Offices 245 Market Street, San Francisco, California

Ind. No. 1

When writing to the Pacific Gas & Electric Co. please mention CHEMICAL & METALLURGICAL ENGINEERING

INDUSTRIAL PLANT SITES



Who will Supply this Demand During 1930?

SINCE the last survey was made, the consumption of chemicals has grown in the states adjacent to Georgia because industry in this region is on a rapid increase. But the production of chemicals has not kept pace.

The figure of $60,000,000 deficit shown in the latest survey, is, therefore, very conservative.

Who will supply this demand during 1930?

In the Atlanta Industrial Area, or close to it, are all the basic raw materials needed to supply this chemical deficit. Production costs are lower, because of savings in such factors as taxes, labor, power, raw materials, building costs and the like. And operation is smoother because of the spirit of the people.

Thus market and manufacturing advantages join hands in this ideal location.

The Atlanta Industrial Bureau will help you investigate the situation as it affects your special division of the Industry. At your request, the trained staff of the Bureau will be placed at your disposal. Or, the Bureau will gladly make a thorough survey for you—without charge or obligation, and in the strictest confidence.

Write

INDUSTRIAL BUREAU, CHAMBER OF COMMERCE
968 Chamber of Commerce Building

ATLANTA

Industrial Headquarters of the South

Send for this Booklet!
It contains the fundamental facts about Atlanta as a location for your Southern branch.

SEARCHLIGHT SECTION

EMPLOYMENT and BUSINESS OPPORTUNITIES—USED and SURPLUS NEW EQUIPMENT

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 5 cents a word, minimum $1.00 an insertion, payable in advance.

Positions Vacant and all other classifications, excepting Equipment, 10 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 inch $6.00
2 to 3 inches..... 5.75 an inch
4 to 7 inches..... 5.25 an inch

Other spaces and contract rates on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

C.&M.

POSITIONS VACANT

ANALYTICAL chemist wanted, experienced in organic and inorganic analysis for research investigations. Location, New York. In reply, please state age, training, experience and salary desired. P-505, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL engineer — A large chemical firm with headquarters in East will consider high type men for chemical development work. Sales promotion experience desirable. Men must be well trained and have exceptional ability. P-534, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

CHEMIST. We have available, both in laboratory and process work, positions for graduates in chemistry or chemical engineering of one to five years' experience. In reply give full details, recent photograph and references. P-524, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

FOREMAN. Must be progressive, able to instruct operators, overcome manufacturing difficulties. Molding experience in rubber, bakelite or composition goods desirable. Steady position with large manufacturing concern in eastern New York. State experience, age and salary desired. P-523, Chemical and Metallurgical Engineering, Tenth Ave. at 35th St., New York.

Chemical Patent Expert

Progressive, rapidly-growing chemical corporation requires full-time services of patent expert capable of assuming executive responsibilities. Applicants should be from 28 to 35 years old and must have graduated in chemistry or chemical engineering from high-grade school. Actual patent experience absolutely essential; reading knowledge of both French and German (or of one, with willingness to learn other) also essential; legal training not essential, but highly desirable. Christians preferred.

P-518, Chemical & Metallurgical Engrg.
Tenth Ave. at 36th St., New York City

Mechanical Engineers, Chemists and Chemical Engineers

The Du Pont Ammonia Corporation offers immediate and permanent employment, and excellent chances for advancement, to properly qualified junior mechanical engineers, chemists and chemical engineers. This is an unusual opportunity for young men of above-the-average training, intelligence, research ability, energy and initiative. Applications from college seniors and graduate students also will receive prompt consideration. No application can be considered which is not accompanied by recent photograph, full statement of training and experience, and at least three references.

Address Mr. Chaplin Tyler
Du Pont Ammonia Corporation,
Wilmington, Delaware

POSITIONS VACANT

HEAT transfer equipment manufacturer desires sales engineers, calculating engineers and designers experienced in the power plant, petroleum, refrigeration and industrial fields. Excellent opportunities for proper applicants. Give full information in first letter. All replies considered strictly confidential. Write Heat Transfer Products, Inc., affiliated with American Locomotive Company, 30 Church St., New York City.

PATENTS, metallurgy. Man experienced in both to prepare and prosecute patent applications. Write giving experience in both lines. P-525, Chemical and Metallurgical Engineering, Tenth Ave. at 35th St., New York.

RESEARCH chemist wanted, experienced in research and development. In reply, please state age, training and experience. P-506, Chemical & Metallurgical Engineering, Tenth Ave., at 36th St., New York.

WANTED

Assistant to Patent Attorney

with growing New York Corporation. Must be experienced in drawing applications. Excellent opening for man able to take on more responsible work as department grows.

PV-493, Chemical & Metallurgical Engrg.
Tenth Ave. at 36th St., N. Y. C.

Chemical Economist

Large chemical manufacturing company has unusual opportunity for chemist or chemical engineer who has specialized in such economic investigations as market surveys, process cost studies, and plant location studies. Sound working knowledge of economics and business principles is essential. Ability to express results in writing clearly and forcefully is equally essential. This is not a job which can be filled by a statistician; nor by a chemist who would like to "try something else." Only high-grade men of experience will be considered.

P-517, Chemical & Metallurgical Engrg.
Tenth Ave. at 36th St., New York City

METALLURGICAL ENGINEER

of exceptional ability and resource is this client. Made millions for his company and himself financially independent thru his work for interests operating metal mines, coal mines and plants in several Middle Western States. Thru our Service connected with a leading rubber products corporation. Writes he, "YOUR SYSTEM IS DIGNIFIED, IT INSURES PROPER CONTACTS. IT IS VERY EFFECTIVE AND YOU USE IT MOST EFFECTIVELY." During our eleven (11) years of operation, we have served hundreds of Chemical Engineers, Metallurgical Engineers, Directors of Research, Superintendents, Sales Managers, Treasurers, Comptrollers, Works Managers, General Managers, and other important men in the chemical industries. These clients you will find from Maine to California. They will all tell you that our Service provides a dignified and effective medium for making new connections. **Individual, confidential**, of course.

JACOB PENN, Inc.
Established in 1919
9 Park Place, New York City

EMPLOYMENT SERVICE

IF you are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established twenty years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 260 Main Street, Buffalo, N. Y.

EMPLOYMENT AGENCIES

WE would like to hear from chemists and metallurgists who might be interested either at the present time, or at some later date, in a new connection. There is no charge or fee of any kind for our service until you have been satisfactorily placed. The Business Service Co., 802 Park Bldg., Pittsburgh, Pa.

POSITIONS WANTED

A THOROUGHLY trained analytical research chemist and chemical engineer, Ph. D. German graduate. Six years' analytical experience in organic, inorganic chemicals, metals, alloys, ores, fertilizers, gases, oils. Knowledge of metallurgy, mineralogy, organic chemistry. Specialized in coal, coke, catalytic research work. PW-521, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL and production executive—process industry—(including cold-moulding formulae and product) eastern trained, wants position anywhere at once. Age 44. Salary first six months at $325. PW-466, Chemical & Metallurgical Engineering, 520 No. Michigan Ave., Chicago, Ill.

CHEMICAL engineer of broad experience desires position in operating end of business. Has conducted research, handled production and cooperated as sales consultant. The position must offer a future. Prefer Metropolitan area. PW-529, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

CHEMICAL engineer. Plant executive; broad production and development experience. Advanced university training in chemistry, engineering and plant administration. Age 30. Available on short notce. PW-519, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL and metallurgical engineer, 15 years' experience in manufacture of chemicals and refining of non-ferrous ores. Research, process development and production executive. PW-533, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

(Continued on the following page)

TECHNICAL SERVICE AGENCY, Inc.

217 Broadway, New York, N. Y.

Specialists in
TECHNICAL PERSONNEL

Patent Engineering Personnel

475 Fifth Ave., New York City

Advises, installs and supervises the work of corporation patent departments and supplies competent patent personnel for established corporation patent departments.

SEARCHLIGHT SECTION

POSITIONS WANTED

(Continued from preceding page)

CHEMIST—executive ability, desires position with future. B. S. degree, six years' experience metallurgical research, experimental, and analytical work. Now employed chief chemist large company Mexico, desires position laboratory or plant executive with oil, chemical, or metallurgical company in Latin-America. Single; fluent Spanish; accustomed to living conditions in isolated tropical regions. PW-456, Chemical & Metallurgical Engineering, 520 N. Michigan Ave., Chicago, Ill.

CHEMIST (analytical), 8 years' practical experience in the analysis of ores, industrial, metallurgical and ceramic materials. 4 years laboratory management. Thorough knowledge of methods. Versatile and accurate. Desires permanent connection as chief chemist or assistant. Graduate, married, 30 years old, references. Salary $300. PW-520, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHIEF chemist and electro-plater, with long experience in analysis of metals, fuels, lubricating oils, and cleaning compounds, desires position in charge of laboratory and plating department. Have installed and operated successfully equipment for chromium, nickel and copper plating. PW-513, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

EXECUTIVE chemist, American, 37, with much diversified experience in industrial research and commercial development in chemicals, oils, paper, cellulose industries, textiles, building materials and other allied chemical lines, desires to change. Unusual combination of chemical skill, business resource and sales service capacity. Much patent experience, extensive linguistic abilities and agreeable personality. PW-522, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

EXPERIENCED chemical engineer - executive, resourceful, energetic and able to think along original lines desires connection, preferably with moderate sized concern where success in advancing the business will be recognized. To my associates I can give loyalty, co-operation and whole hearted effort. A large salary is less important than a future holding promise. Location near New York is preferred. I shall gladly furnish further details to those interested, but would prefer to do so personally. PW-528, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

RECENT university graduate, B.S. in chemical engineering; age 23; would like to become associated with a reliable chemical organization. Six years' experience in industrial work. Can handle men. At present employed but seeks a position of responsibility where ability and conscientious work will be recognized. Familiar with designing and hydrogenation of oils. Ambitious. PW-532, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

RUBBER chemist, university graduate, age 26, and married. Now employed as chief chemist in a rubber reclaiming company in the Middle West, desires change. Five years' experience in laboratory control and development work in compounding of all types of rubber articles and the manufacture of various types of reclaimed rubber. Desires position either on West Coast or a foreign country where the above training would be of use. Familiar with German. PW-526, Chemical and Metallurgical Engineering, 520 No. Michigan Ave., Chicago, Ill.

SAFETY glass. Chemical engineer, with considerable experience and information in the manufacture of pyroxylin plastics and their lamination in safety glass, wishes permanent or consultant connection with company manufacturing non-shatterable glass. PW-497, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

YOUNG man, chemical training, organic and inorganic, wants position with growing concern in New York or Brooklyn. Five years' experience with large dyestuff concern. Three years in charge of coloring on intaglio and surface printing machines. Experienced in rapid analytical work in steel plant, laboratory. Versatile and adaptable. PW-507, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

REPRESENTATIVE AVAILABLE

Sales Engineer

Graduate mechanical, age 44, with office in New York City, seeks representation of worthy product in Eastern territory. RA-535, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

Sales Manager Available

Chemical sales engineer, 10 years' experience in selling. Thoroughly conversant with modern sales methods. Position wanted with company located in smaller city or town. Large acquaintance with Buyers and Executives in process industries. Now employed, but available at short notice. Reasonable salary.

PW-484, Chemical & Metallurgical Engineering Tenth Ave. at 36th St., New York

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Company with subsidiaries selling nationally and internationally in different marketing fields seeks to add

OUTSTANDING NEW PRODUCTS

to their lines.

The company is therefore willing to take over patent rights covering approved laboratory developments or products that are already in a production stage.

Such products must be proved to be salable in one of the following fields:

1 COMPOUNDS obtained by mixing, blending or simple chemical compounding, containing some substance derived from petroleum. Salable in bulk to Railroads, Transportation Companies and all classes of large manufacturing plants.

2 PRODUCTS containing some substance derived from petroleum salable to:

Manufacturers of:	*Retailers:*
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Cosmetics	Paper
Food Products and Confectionery	Drug Stores
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	Department Stores

M-530, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York

SALESMAN WANTED

Salesman

(Explosives), age 25 to 30, for old-established and well known corporation, graduate mining engineer with technical sales or mining experience in Mexico or South America. Should have strong sales personality and speak Spanish fluently. Short period in States, then foreign service. Good opportunity. SW-527, Chemical and Metallurgical Engineering, Tenth Ave. at

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Patented Specialties to Manufacture

Large well equipped plant with plate fabricating shop, pattern shop, foundry and machine shop, wishes to secure patented specialties to manufacture. Complete information should be submitted for consideration. BO-475, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

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1—350-gal. Jacketed, Agitated.
1—600 gallon Valley Iron, Jacketed, Agitated.

DRYERS

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1—Proctor Tunnel Dryer.
2—Proctor 2-truck Dryers.
1—6-truck Gordon-Davis 1800 sq.ft.
1—12 truck, Gordon and Davis, 3600 sq. ft.
1—Proctor Truck Dryer, 1,200 sq.ft.

Vacuum Shelf—Devine

10—No. 12; 4—No. 23; 6—No. 25; 2—No. 27; 3—No. 32; brand new, complete, 3—No. 58.

Vacuum Shelf—Buff. Foundry

1—Double door, 15 shelf; shelves 11' 10" longx5' wide.

Drum

1—3'x6'6" B. & C. Atmospheric.
1—4'x9' B. & C. Atmospheric dbl. drum.
1—4'x6' Atmospheric.
1—4'6"x12' Atmospheric dbl. drum.
1—6'x6' Buffalo Atmospheric.

Rotary Vacuum

1—Devine 3x15 ft.
1—Stokes 4x15 ft.
1—Devine 5x25 ft., complete.
1—Devine 5x33 ft., complete.

Rotary Vacuum Drum

1—40x80-in. bronze copper lined.
1—40x80-in. bronze, Devine.
1—52x126-in. bronze, Devine.

Rotary—Direct and Indirect Heat

2—4x20-ft. Bartlett & Snow.
1—4x30-ft. Ruggles Coles.
1—5x30-ft. Ruggles Coles.
1—6x60-ft. American Process.
4—8x60-ft. Ruggles Coles.
18—3x12-ft. to 8x85-ft., all makes.

CENTRIFUGALS

Belted and Motor Driven with Copper and Steel Baskets

4—60-in. Tolhurst.
3—48-in. Tolhurst.
21—30-in. to 36-in. Tolhurst, American Laundry, Troy, etc.
6—48-in. Fletcher.
5—40-in. Tolhurst.

Steam Driven

4—48-in. Fletcher.
1—48-in. Tolhurst.
1—40-in. Fletcher.
1—30-in. Fletcher.

FILTER PRESSES

Iron and Wood, Open and Closed Delivery, Recessed Plate and Frame

4—Shriver and Johnson 36x36-in.
12—Shriver and Sperry 30x30-in.
2—Johnson 24x24 in.
2—Shriver 18x18 in.
1—Shriver 18x18-in., lead.
12—Shriver, Johnson, 12x12-in.

SWEETLAND FILTERS

1—No. 11; 1—No. 10; 2—No. 7; 2—No. 5; 1—No. 2.

OLIVER FILTERS

1—3x2, 3—6x4, all iron, 2—6x6, wood staves.
2—6x6, Acid Proof.
1—8x9, Wood.
1—8x12, all iron.

W. & P. MIXERS

1—Size 8, jacketed, 4½ gal.
1—Size 11, jacketed, 9 gal.
1—Size 12, unjacketed, 20 gal.
1—Size 14, jacketed, 50 gal.
1—Size 14, unjacketed, 50 gal.
2—Size 15, jacketed, 100 gal.
2—Size 17, unjacketed, 200 gal.
1—Size 17, jacketed, 200 gal.
1—Size 30, jacketed, 2,300 gal.

SPECIALS

1—J. P. Devine 5-ft.x33-ft. Rotary Vacuum Dryer, complete.
1—Zaremba Iron Triple Effect Evaporator, 1030 sq.ft. each effect. Horizontal copper tubes.
3—30-in.x30-in. Shriver Iron, Filter Presses, plate and frame, 32 chambers.
3—W. & P. Mixers; size 15, type VI, class BB, 100 gallon working capacity.
30—Dopp Steam Jacketed, agitated Kettles, 50 gal. to 200 gal.
12—6-ft.x22-in., 6-ft.x30-in., 8-ft.x30-in., Hardinge Conical Ball Mills, each equipped with cast steel cut, herringbone gear and pinion.

MIXERS

6—5,000 gal. Vertical, Coils.
1—1,000 gal. Day, jacketed.
3—500 gal. Stokes, jacketed, Dough.
2—500 gal. Day, jacketed, Jumbo.
24—Dough Mixers, 1 bbl. to 6 bbl.
6—60 gal. and 100 gal. Day Imperial.
14—Sizes A, B, C and D, Day Sifters and Mixers.
2—Broughton Mixers, 1200 lb. and 1500 lb.

EVAPORATORS

2—Swenson Single and Double Effect, 250 sq.ft.
1—Stokes Triple Effect, 1,000 sq.ft.
1—Scott Triple Effect, 1,350 sq.ft.
2—Triple Effect, 1—Swenson 1,750 sq.ft. and 1—Zaremba 3,200 sq.ft.

SULPHUR BURNERS

2—Glens Falls Sulphur Burners, 4x16-ft. complete.

VACUUM PUMPS

All sizes and types in stock.

KETTLES

All Types and Sizes

300 in stock—open top, closed, jacketed and unjacketed, with and without agitators, with and without copper and steel coils, vertical and horizontal.

Made of Cast Iron, Steel, Copper, Aluminum, Glass Lined, Lead Lined, Duriron and Monel Metal.

Capacities from 25 gals. to 30,000 gals.

DISTILLING UNITS

8—12-in. to 60-in. copper columns with condensers.
23—Fractionating Columns, complete, 12-in. to 84-in.

VACUUM PANS

10—Copper, 25 gal. to 600 gal.
2—100 gal. Aluminum jacketed Pans complete.
1—6-ft. Copper Vacuum Pan.
1—7-ft. Cast Iron Vacuum Pan.

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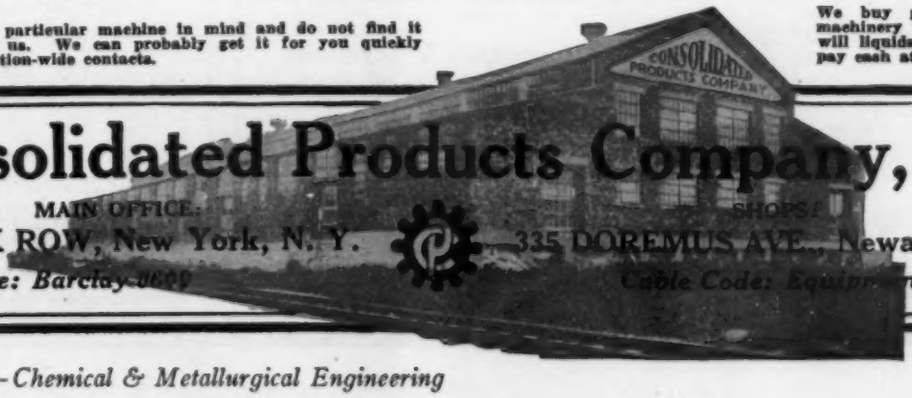

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of Reconditioned Machinery

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DRYERS—KILNS
1—2x16-ft. Rotary, Steam tubes.
2—5-ft. x 35-ft. American.
9—Ruggles-Coles A2, 10, 12, 14, 18 and F2.
1—6-ft. x 60-ft. Bonnot.
1—4x30-ft. Amer. Process.
1—5x40-ft. Amer. Process.
1—8x80-ft.x½-in. Steel Shell.

DRYERS—TRAY AND TRUCK
4—2, 4, 8 Truck, Gordon, Proctor and Hurricane.
3—Tray Type Proctor and Gordon.

DRYERS—VACUUM SHELF
12—Nos. 5, 11, 12, 20 and 23 Devine.
1—F-20 shelf Buffalo.

DRYERS—ROTARY VACUUM
2—3-ft. x 15-ft. Stokes, Devine.
1—4-ft. x 20-ft. Devine.
1—5-ft. x 30-ft. Buffalo.

EXPELLERS
2—No. 1 Anderson, Motor Driven.
2—No. 1 Anderson, Pulley Driven.

EVAPORATORS
1—Single Effect Zaremba, 300 sq. ft.
4—Single Effect Zaremba, 1,670 sq. ft.
1—Single Effect Swenson, 3,300 sq. ft.
1—Double Effect Swenson, 1,400 sq. ft.
1—Double Effect Zaremba, 2,700 sq. ft.
1—Triple Effect Lillie, 2,000 sq. ft.
1—Triple Effect Oats, 4,200 sq. ft.
1—Quad. Effect Zaremba, 5,400 sq. ft.
1—Quadruple Effect Oats, 12,000 sq. ft.

CENTRIFUGALS
15—20, 26, 30, 36, 40, 42, 48, 54, and 60-in. Tolhurst, Fletcher & Amer. Ldry. makes.
1—Battery 40-in. Amer. Tool, suspended type.

CENTRIFUGES
5—No. 600 & 601 De Laval Clarifiers.
2—No. 6 Sharples Centrifuges.
1—Style A, De Laval Centrifuge.

SPECIALS

1—8 Truck Proctor Dryer.
12—Abbe, Size 3, Pebble Mills.
1—No. 10 Sweetlands, Monel leaves.
4—W. & P. Mixers, sizes 14 and 15.
1—Zenith Filter, 6-ft.x4-ft.4-in.
2—American Filters, 8 and 6-ft. dia.
3—Oliver Filters, 3x2-ft., and 3x4-ft.
1—Tyler Hummer Screen.
1—6x60-ft. Rotary Dryer.
7—Dopp Kettles, 60 to 250 gallons.
4—Centrifugal Pumps, 12 in. and 8 in.

DRYERS—DRUM
1—40x80-in. Devine Bronze Vac.
1—40x80-in. Devine Vac.
2—5-ft. x 13-ft. Buffalo and Stokes Atmospheric.

SWEETLAND FILTERS
8—Nos. 1, 2, 5, 7, 10 and 12.

ROTARY FILTERS
8—3x2, 6x4, 6x6, 8x6, 8x12 Olivers.
2—6-ft. and 8-ft. American 2 and 4 Disc.

FILTER PRESSES
10—12, 18, 24, 30, 36, and 42-in. sq. Iron and Wood.
3—12-in. and 18-in. Shriver lead.

WERNER & PFLEIDERER MIXERS
2—Size 11 Unjacketed, 9 gals.
2—Size 14 Jacketed, 50 gals.
2—Size 15 Jacketed, 100 gals.
2—Size 15, Type VIII, Unjacketed.
1—Size 30 Jacketed, 2650 gals.

PEBBLE MILLS
5—6x4, 6x8, 7½x6, and 7x10-ft.
16—4½x3½ Abbe, lined and unlined.

GRINDERS
8—Schutz-O'Neil 16-in., 20-in., 22-in., 28-in.
5—Meade Mills, Nos. 1, 2, 3.
6—Raymond Mills No. 1, No. 0, No. 00, No. 000, No. 0000.
3—Raymond Four Roll.
1—Special A Williams Hammer Mill
3—Abbe, Ball and Jewell Cutters.
6—Cage Mills, 12-in., 18-in., 24-in.

KETTLES
80—Made of Cast Iron, Steel, Copper, Aluminum, Lead and Glass Lined, capacities 10 to 3,000 gals; Jacketed and Plain, open and closed tops, with and without agitators.

HARDINGE MILLS
4—2 ft. x 8 in.; 4½ ft. x 16 in.
1—6-ft. x 22-in.
1—8-ft. x 30-in.

TANKS—ENAMEL
10—100-1000 gal. Pfaudler.
7—Pfaudler 7 to 10-ft. dia.

MIXERS
3—One bbl. Day, 50 gals.
2—100 gal. Reade & Ross.
3—50, 100 gal. Day Imperial.
6—Dough Mixers, tilting, 1 to 8 bbls.
10—Day Dryer Powder, 50 to 2000 lbs. capacity.

CONDENSERS
24—20 to 3,000 sq. ft., copper and steel tubes, horizontal and vertical.

DISTILLING UNITS
10—10 to 60-in. copper and steel Badger, Lummus, Case, etc., makes.

VACUUM PUMPS
25—Single and two stage motor, belt and steam driven, Devine, Buffalo, Amer., etc., makes.

VACUUM PANS
5—Copper 25 gal. to 1000 gals.
3—7 to 10-ft. dia. Cast Iron.
6—4-ft. to 8-ft. Copper Vacuum.

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1—Kane Gas Boiler.
1—Drug Mill.
2—Granulating Mixers.
2—Stokes Rotary Tablet Machines.
1—Stokes Eureka Tablet Machine.

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3—Welded Steel Autoclaves, 3-ft. inside diameter by 10-ft.3-in. long; working pressure 300 lbs. per sq.in. Tested to 1,000 lbs. pressure. Complete with steel setting.

REDUCERS

4—Buffalo Standard Reducers, 6-ft.4-in. diameter by 8-ft. high; complete with liners, scrapers and agitator.

12—Buffalo Standard Reducers, 6-ft. diameter by 8-ft. high; complete with liners, scrapers and agitator.

CAST IRON POTS

1—Cast Iron Kettle, 10-gallon capacity; inside diameter 15-in.; depth, 15-in. with bolted cover.

1—Cast Iron Pot, open top; 4-ft. diameter by 5-ft. deep; wall 1⅛-in. thick.

6—Cast Iron Pots, with covers; 5-ft. diameter by 4-ft.8-in. deep walls 1½-in. thick; pot has four supporting lugs; cover has two manholes, one 18-in. diameter and one 20-in. square.

6—Cast Iron Pots, open top; 1-ft.6-in. diameter by 4-ft. deep; walls, 1-in. thick.

ACID EGGS

2—Cast Iron Acid Eggs, bolted head; 42-in. diameter by 62-in. deep; walls, 2-in. thick.

1—Cast Iron Acid Egg, both heads bolted; 48-in. diameter by 96-in. long; walls, 2½-in. thick.

BLOW CASES

2—Steel Plate Blow Cases, 3-ft.6-in. diameter by 12-ft. long; made from ½-in. plate; double riveted throughout.

STILLS AND COLUMNS

1—J. P. Devine Beta-Naptha Still; cast iron pot 5-ft. diameter by 6-ft. deep with cover and vapor pipe; 2 jacketed receivers, cast iron shells with steel jackets, 2-ft.6-in. inside diameter by 5-ft. long, with cast iron hinged heads.

2—Steel Still Pots, horizontal; 7-ft.6-in. diameter by 8-ft. long; 5/16-in. plate; double lap riveted; coils of 18 turns 1½-in. pipe, 7-ft. long.

1—Crude Oil Still, horizontal; 8-ft. diameter by 17-ft.6-in. long; ⅜-in. plate; double lap riveted; 455 sq.ft. heating coil made up of 3-in. tubes; complete with cast iron rectifying column 4-ft. diameter by 5-ft.5-in. high, 5 plates with boiling caps; steel shell dephlegmator 5-ft.4-in. long; 3-ft.8-in. wide; 5-ft. high; with 126—1½-in. U tubes; one condenser, horizontal, steel shell 4-ft. diameter by 9-ft. 9-in. long with 877 sq.ft. condensing surface.

1—Steam Stripping Still or Column; 4-ft. diameter 23-ft.4-in. high; 21 plates with boiling caps; all iron construction; complete with connections, gauges, thermometers, etc.

1—Vertical Still, shell and coil type; steel tank, 11-ft. diameter by 14-ft. high; ½-in. plate; 9,700 gallons capacity; two coils of 4-in. ex. hvy. pipe, 8-ft. and 4-ft. diam., 10 coils high; complete with all necessary connections.

3—Direct Fire Stills, horizontal; 8-ft.3-in. diameter by 21-ft.1½-in. long; ¼-in. plate; 236 degrees of circumference; is fire box steel, balance boiler steel; double lap riveted; complete with steel supports, vapor outlet and fittings.

CONDENSERS

4—Steel Coil Condensers, in open top rectangular tanks, 5-ft.8-in.x4-ft.5-in.x3-ft.; 240 sq.ft. condensing surface.

4—Badger Vertical Tubular Condensers; 3-ft.6-in. diameter by 7-ft.7-in. high; 130 tubes, 2-in. diameter.

1—Oil Condenser or Heat Exchanger; 2-ft.6-in. diameter by 15-ft.6-in. high; case iron heads; 190 tubes, 1¼-in. diam. by 12-ft.9-in. long.

1—Oil Condenser or Heat Exchanger; 2-ft.6-in. diameter by 8-ft. high; cast iron heads; 170 tubes; 1-in. diameter by 6-ft.6-in. long.

3—Vertical Tubular Condensers; 12-ft. diameter by 24-ft.6-in. high; 12,000 sq.ft. condensing surface; 770 tubes, 3-in. diameter by 20-ft. long; shell of ⅜-in. and 5/16-in. plate; tube sheets ½-in. plate.

TAR EXTRACTOR

1—Bartlett-Hayward Tar Extractor; steel, ¼-in. plate; with perforated baffles, spray heads and necessary vapor and liquor connections, drains, etc.

SCRUBBING TOWERS

2—Vertical Scrubbing Towers; 9-ft. diameter by 67-ft.2-in. high; ¼-in. and ⅜-in. plate; 24-in. vapor connections and pipe; packed with cypress grids. Complete with oil catch tanks, pump tanks and connections.

OIL WASHER

1—Cast Iron Cone Bottom Agitator or Oil Washer; 5-ft. diameter by 7-ft.8-in. high overall; wall, 1¼-in. thick.

CENTRIFUGAL WRINGER

1—American 30-in. Centrifugal Wringer; basket 30-in. diameter; with 2.6 hp. direct belted motor on common base.

LIME HYDRATOR

1—J. P. Devine Lime Hydrator; steel tank with agitator and drive, steel housing and all fittings; practically new.

AMMONIA CONDENSERS

1—Cast Iron Condenser; rectangular; with 80 aluminum tubes, 2-in. diameter by 4-ft.5-in. long; all complete.

1—Aluminum Concentrator for Ammonia; six sections, with cast iron headers.

CENTRIFUGAL WASHER

1—Feld Vertical Centrifugal Washer; 7-ft. inside diameter by 29-ft.5-in. high; 9 sections, each with revolving steel plate cone washer; direct connected to 10x10 steam engine; washer operates at 115 r.p.m., complete with bearings, piping, overflow tank, pump and all fittings.

DECANTING TANKS

1—Decanting Tank, elliptical shape, 4-ft. deep; 1350 gallons capacity; with baffles, overflow pipe and seal pot.

1—Decanting Tank, elliptical shape, 4-ft. deep; 850 gallons capacity; with baffles, overflow pipe and seal pot.

CRUSHERS AND GRINDERS

1—Holmes and Blanchard Disintegrator; size, 36-in.; steel breaker and four rows breaking pins.

3—Williams No. 3 Dustless Coal Crushers; six rows hammers; patent metal arrester; direct connected to 50 HP., 440 volt motors.

1—Williams No. 1 Universal Fine Grinder; capacity 4 to 5 tons per hour.

1—Kennedy Van-Saun Ball Mill, 8-ft. diameter by 6-ft. long; "Herculite" steel liners; comparatively new condition.

1—American Ball Mill, 4-ft. diameter by 8-ft. long; steel liners; belt and pulley drive.

1—Standard Ball Mill, 4-ft. diameter by 3-ft. long; steel liners; complete with drive.

1—Allis-Chalmers Tube Mill, 4-ft.6-in. diameter by 12-ft. long; silex lining; practically new condition.

1—F. J. Smidth Tube Mill, 4-ft. diameter by 16-ft. long; silex lining; complete with drive.

1—Gardner No. 2B Crusher.

CRYSTALLIZING PANS

2—Steel Plate Jacketed Crystallizing Pans, 6-ft. diameter by 2-ft. deep; shell and jacket ⅜-in. plate; overflow spout and trough.

1—Steel Evaporating Pan, 6-ft. diameter by 2-ft. deep; shell ⅜-in. plate; overflow spout and trough.

1—Steel Evaporating Pan, 8-ft. diameter by 2-ft. deep; shell ⅜-in. plate; capacity, 1000 gallons.

MIXERS

2—Stokes Mixers or Grainers; cast iron trough with steel jacket; gear drive; capacity approximately 300 gallons.

EVAPORATORS

1—Triple Effect Yaryan Type Evaporator; drums, 57-in. diameter by 25-ft.2-in. long; 1750 sq.ft. per effect; complete with condenser, preheater, pumps, vacuum pump, catch tanks and accessories.

2—Swenson Vertical Evaporators, Triple Effect, basket type; 1850 sq.ft. per effect; complete with preheaters, condensers, pumps and all accessories.

LEECHING CELLS

4—Leeching Cells, 4-ft. diameter by 11-ft.5-in. overall; ⅜-in. plate, cone bottoms; new, never installed.

CHEMICAL STONEWARE

From the acid plants at Old Hickory we have available a stock of chemical stoneware, consisting of special items such as Hart Condenser manifolds, surge pots, special tees and elbows and other items. A complete stock list is available and will be sent on request.

DURIRON FITTINGS

We still have available a large stock of Duriron pipe and fittings, consisting for the most part of specials and large pipe from the Nitric Acid plants. A complete list is available and will be sent on request. This material is being priced especially low for quick sale.

HART CONDENSER TUBES

2000—3-in. diameter Glass Tubes, 6-ft.4-in. long. All new stock.

STORAGE TANKS

Right at this time we have a very complete stock of steel storage tanks in various types and sizes. The tanks are located at Old Hickory, Clinchfield, Va., Gordon, Ga., and in our storage yards at Bristol, Va., and Kingsport, Tenn. We have horizontal and vertical storage tanks, small process tanks, both closed and open top, pump tanks and a wide variety of sizes. A complete list has been prepared and will be sent on request.

NITRATING EQUIPMENT

From the Nitrocellulose Plants at Old Hickory we still have available a stock of spare parts for the standard 42-in. nitrating units. These parts include dipping pots, agitators, motors, shafting, couplings, wringer heads, brake assemblies, valves, fittings and miscellaneous items. A special list has been prepared of these parts.

BRIQUETTING PLANT

Our Clinchfield plant contains a complete coal briquetting unit of 40 tons hourly capacity. It is made up of two Komareck briquetting presses of 20 tons per hour capacity, complete with Rutledge Fluxers, Paddle Mixers, Pitch Binder Mixers, direct connected motors and all fittings and accessories, including cooling conveyor and tower. It is practically new and intact. The complete set of blue prints is available for those interested in such an installation. In addition to the above presses we offer two additional presses:

1—Komareck Briquetting Press, roll and chain feed type, capacity 15 tons per hour. Complete with gear drive, extra mold wheels and vertical fluxer.

1—Belgian Briquetting Press, plain mold wheel type, capacity, 12 tons per hour. Complete with fluxer and drive.

THERMOMETERS

134—Welskopf Brass Case enclosed Thermometers, 20 to 80 degrees C.

33—Welskopf Brass Case, enclosed Thermometers, 10 to 40 degrees C.

7—Welskopf Brass Case, enclosed Thermometers, 20 to 110 Degrees C.

2—Schaffer and Budenburg Brass Case, enclosed angle Thermometers, 40 to 120 Degrees C.

1—Schaffer and Budenburg Brass Case, enclosed angle Thermometer, 0 to 70 degrees C.

12—Precision Enclosed Thermometers with 40-in. stem., 200 to 750 Degrees F.

RECORDING THERMOMETERS

95—Columbia Recording Thermometers, 20 to 70 degrees C., chart No. 675.

11—Columbia Recording Thermometers, 20 to 70 degrees C., Chart No. 470.

6—Columbia Recording Thermometers, 20 to 70 degrees C., Chart No. 100.

Note—All the above thermometers are new and have never been installed. Many are in original cases.

Following are just a few of the many items available from a recent purchase:

PAPER MACHINES

1—Downington 112-in. Trim, Six Cylinder Machines, complete with screens; 60 dryers, 42-in. dia. by 118-in. long; two stacks calenders; double reel, slitter and winder.

1—Fourdrinier Machine, 60-in. Trim, Fourdrinier screen 68-in. wide by 40-ft. long; 12 dryers 36-in. diameter by 66-in. long and 20 dryers 28-in. diameter by 66-in. long; one set calender rolls; double reel, slitter and winder.

1—Rogers Wet Machine, 72-in. wide, with two 48-in. by 72-in. cylinders and boxes; one set press rolls; 30 dryers 28-in. diameters 68-in. long; two stacks calenders.

BEATERS

4—Downington 1,800-lb. Capacity Beaters.

2—Dayton 3,000-lb. Capacity Beaters.

2—Noble and Wood 1,800-lb. Capacity Beaters.

2—Noble and Wood 1,200-lb. Capacity Beaters.

BREAKER BEATER

1—Continuous Breaker Beater, 120,000-lb. daily capacity.

JORDAN ENGINES

4—Noble and Wood Monarch No. A, Jordan Engines.

3—Miami No. 2 Jordan Engines.

2—Claflin 40-in. diameter Refining Engines.

DIGESTERS

4—Welded Steel Digesters 7-ft. diameter by 21-ft.

Plants at Old Hickory, Tenn.; Clinchfield, Va.; Gordon, Ga. Storage Yards at Kingsport, Tenn. and Bristol, Va.

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We carry a large stock of Agitator Drives and are equipped to build standard or special Agitators for mixers of any size or type.

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Vulcan, 250 gal., direct fired.

Blowers

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Spencer Turbo (2).
Beach Russ 18x12.
Nash No. 1.

Centrifugals

20-in., 26-in., 30-in., 36-in., 42-in. and 48-in., copper and steel Baskets, belt, motor and steam driven.

Clarifiers

De Laval No. 200, No. 300 and No. 600.
Hardinge Clarifier.
Dorr Thickener.

Compressors

Ingersoll-Rand 8x6.
Ingersoll-Rand 8x8.
Ingersoll-Rand 12x10.
Westinghouse Traction—D. 4 K.
Chicago Pneumatic 8x8.
Curtis Duplex 10x10.

Crushing Rolls

Farrel Power and Mining.
Allis-Chalmers.
Bacon.
Clay Rolls, Coal Crushers and Ore. 12x12, 24x12, 28x16, 28x30, 36x16.

Jaw Crushers

9x15, 10x16, 6x20, 7x24, 15x30.

Dryers—Atmospheric

Gordon Type B, 300 sq.ft. tray type.
4-truck Atmospheric, 450 sq.ft.
Proctor & Schwartz. 2 and 3 truck.
Hurricane.

Rotary, Direct and Indirect Heat

Ruggles-Coles 4x10-ft.
Bartlett & Snow, 3x20-ft.
Christie Indirect, 5-ft.x16-ft.
Cummer, 4½x30-ft.
Bonnot, 6½x15-ft.
Buffalo, 6x6-ft.

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Some Lyre, we might say, and yet, it may have been only the imagination of a sublime optimist who was wishing while dreaming.

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Ruggles-Coles, 6x100-ft.

Rotary Vacuum

Devine & Stokes, 2x8-ft., 3x15-ft., 4x20-ft.

Vacuum Shelf

5 to 20 Shelf, Devine, Stokes, Buffalo.

Evaporators

Swenson, Devine, Stokes, Buffalo, Zaremba horizontal, vertical-single, double, triple and quadruple effects.

SPECIAL

Atlas 1-bag concrete mixer with gas eng.

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Rockwell, 1 ton.
Rockwell Annealing Furnace.
U. S. Smelting No. 4.
Simplex No. 3 smelting.

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6-in.x6-in. to 42-in.x42-in. iron and wood, recessed and plate and frame, open and closed delivery.

Filters

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American all iron, 6-ft.x12 leaf.
Kelly No. 36.
International 20-in.

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Williams & Grundle Hammer Mills. Several sizes.
Shutz-O'Neill, 28-in., 30-in., 32-in.
Cogswell, 18-in., 24-in.
Pulverizing Machinery Co., 12-in. Pulverizer.
Fuller-Lehigh, 46-in., 33-in.
Mead Mill No. 3.
Raymond, No. 1 and 000.

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Cast Iron, Steel, Copper, Aluminum, Glass Lined, Lead Lined, Jacketed and Plain, open and closed tops, with and without agitators, capacities 10 to 10,000 gallons.

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Traylor Ball Mill, 4-ft.x4-ft.
Hardinge Mills, 4½-ft., 5-ft., 6-ft., 7-ft.
Ball & Pebble Mills, 24-in.x24-in. to 7½x6-ft.
Abbe Tube Mills, 4½x20-ft., 5x22-ft.

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Day Change Can, 3 to 40 gallons.
Blystone Foundry Mixers.
Rockwell, 250 gal., jacketed.
Dough Mixers, 1 to 4 bbl.
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800 Gallon Aluminum.
25 to 600 gallon Copper.
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2—6x4-ft. Oliver Continuous Drum Type Filters.

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1—6-ft.x16-in. Hardinge Conical Ball Mill.
1—6-ft.x22-in. Hardinge Conical Ball Mill.
1—6-ft.x30-in. Hardinge Conical Pebble Mill.
2—6-ft.x18-ft. Joshua Hendy Tube Mills.
1—6-ft.x6-ft. Denver Ball Mill.

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3—14x6-ft. Dorr Thickener Mechanisms, with Redwood Tank and Steel Superstructure.
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2—Ross Crusher Grinders
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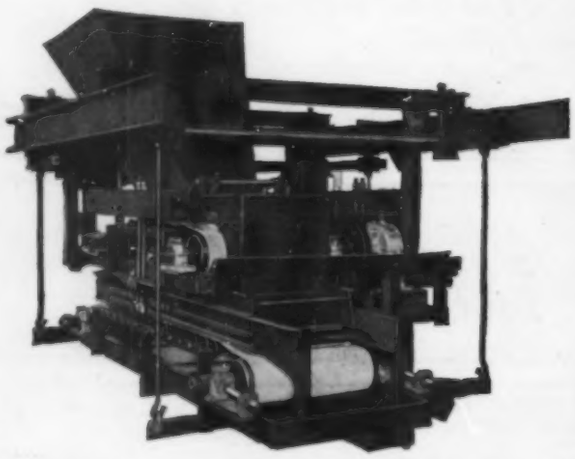

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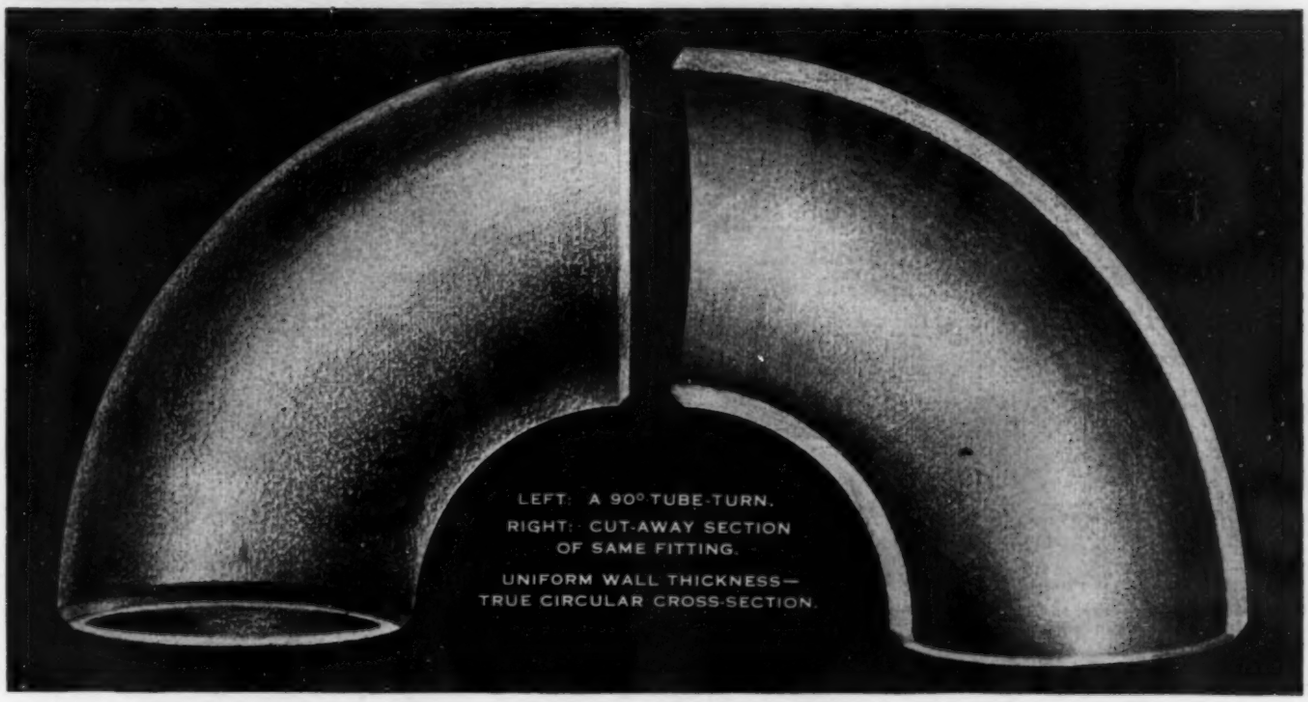

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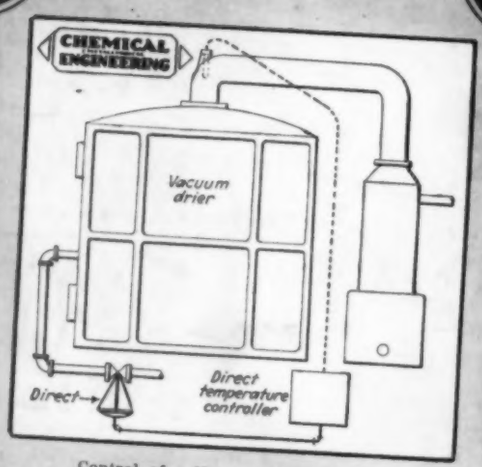

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